Best Practices for the Integration of Climate Change Adaptation and Mitigation into Environmental Assessments

Prepared for

Ontario Climate Consortium | Toronto Region Conservation Authority (TRCA)

Prepared by

K-NEX Consulting

Connecting you to a sustainable future

April 14, 2015

DISCLAIMER

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The following is a report completed by K-NEX Consulting, commissioned by the Ontario Climate Consortium (OCC) and the Toronto and Region Conservation Authority (TRCA).

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Executive Summary

Climate change has become apparent both locally and globally, and the impacts are placing stress on the infrastructure of the built, natural, social and economic environments. This has resulted in high economic costs for both governments and individuals. Infrastructure damage has cost the province of Ontario millions of dollars. The province's stance towards climate change has been reactive in nature, resulting in an unsustainable cost burden. If the province of Ontario takes a proactive approach to planning that integrates climate change adaptation and mitigation such as through Environmental Assessment (EA) it will reduce the province's vulnerability to the changing climate.

Currently, no formal guidelines for climate change considerations are present in the Ontario Environmental Assessment Act or the Ontario Ministry of the Environment and Climate Change Codes of Practice Guidelines for EA. Although no regulatory guidelines exist within the province, provincial authorities have identified climate change adaptation and mitigation as a priority. In order to fill the existing gap in legislation, K-NEX Consulting identified existing best practices for integrating climate considerations into EA processes, and developed a guidance document for specific application of the considerations into the Ontario EA process. This involved the review of existing literature to inform the development of a guidance document and a case study analysis to assess the applicability of the guidance document in informing projects within Ontario.

Literature Review: The literature review was conducted at three levels whereby literature searches were conducted at the provincial, national and international levels through a semi-structured method. The literature review provides a summary of the common themes regarding climate change, project planning, and EAs. Eight major themes were identified from the literature searches as follows:

1) Relationship between Climate Change and Adaptation/Mitigation;
2) Green Infrastructure and its Relationship to Climate Change;
3) Existing Climate Change Adaptation and Mitigation Policies and Plans;
4) Existing Guidelines for the Integration of Climate Change Considerations into EAs;
5) Challenges and Barriers to the Integration of Climate Change Adaption Mitigation into EAs;
6) The Uncertainty of Climate Change and its Impact on the Successful Integration of Climate Change Considerations into EAs;
7) Importance of Stakeholder Engagement for the Integration of Climate Change Considerations into EAs; and,
8) Integration of Climate Change Considerations at Project Level and Strategic Level of EA.

Best practices regarding the integration of climate change considerations into EAs were found from the identified themes within the literature review. One key literature review finding indicates that while EA procedures should be amended to integrate climate change considerations. Amendments are a time intensive process and in the interim, guidance documents may provide the quickest approach to integrating climate change within EA practice.

Guidance Document: A practitioner guideline was developed from the best practices identified from the literature review. The intended use of the guideline document is to provide a framework to inform EA practitioners on best practices for the integration of climate change considerations into the Ontario EA process. This document provides an opportunity for users to identify vulnerabilities and verify the resilience of their projects. It allows practitioners to address climate change threats that are unique to their region and project through existing EA tools and through the phases of the Ontario EA process.

Case Study: The case study provided an example of how the practitioner guideline can be applied to project planning in Ontario. Analysis of the case study examined the effectiveness and adaptability of the practitioner guideline in informing project planning. The Terms of Reference (ToR) for the EA of the proposed Allen Road project in the City of Toronto was used for the case study. An analysis of the case study determined that the practitioner guideline can inform the ToR stage of an EA process. The guideline was determined to be effective as it is applicable to the requirements of a ToR under the Ontario EA Act, is clearly communicable, presents new and useful information for the proponent to consider, and provides next steps for the EA practitioners working on the Allen Road EA. The case study furthermore enhances the understanding of the practitioner guideline, and its applicability to existing projects.

Recommendations and Next Steps: Guidance documents are recommended as a best practice to integrate climate change considerations into the Ontario EA process. The practitioner guideline was produced as a reflection of this best practice, and can be applied to projects that fall under the Ontario Environmental Assessment Act. Due to the intentionally broad nature of the practitioner guideline, the guideline can be used as a framework to create technical guidance documents that are specific to project types. To produce a truly proactive planning system within Ontario, climate change should be addressed at both project level EA planning and strategic level EA planning. If Ontario is able to successfully adopt guidelines for the integration of climate change considerations into EAs, practitioners will be provided with the necessary tools to develop more proactive planning practices.

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1.0 Introduction

Climate change has become apparent both locally and globally, and the impacts are placing stress on the infrastructure of the built, natural, social and economic environments. This has resulted in high economic costs for both governments and individuals. Historical data indicates that the province is experiencing shifts in seasons, with shorter winters, earlier springs, and more intense precipitation events due to climate change (Ministry of the Environment and Climate Change, 2015). In Ontario, climate change impacts influence infrastructure such as buildings, roads, transmission lines, drinking water and water treatment services, natural gas, communication lines and bridges. The impacts of climate change in Ontario range from freeze thaw cycles that cause cracking of pavements, flood events, ice and windstorm damage, and softening of tarmac during summer heat waves (Government of Ontario, 2011). The province's stance towards climate change has been reactive in nature, resulting in an unsustainable cost burden. The payout due to extreme weather events has doubled since the 1980s and the losses in Ontario and Alberta due to flooding in 2013 hit a record 3.2 billion dollars (MOECC, 2015). Had the province of Ontario taken a proactive approach to planning that integrates climate change adaptation and mitigation, such as through Environmental Assessment (EA), it would have reduced the province's vulnerability to the changing climate. Over the next ten years, the province of Ontario plans to invest over 10 billion dollars in infrastructure. The province's economy and level of climate risk will be shaped by the planning of this investment.

At the national level, the Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment supported by the Canadian Environmental Assessment Agency (FPTCCCEA) has developed a guidance document for the implementation of climate change considerations into the EA process at the federal project level (FPTCCCEA, 2003). In Ontario, the provincial government is currently transitioning towards the implementation of planning strategies focused on climate change. Regulatory bodies within the Ontario context are in the initial stages of creating a legislative framework for the integration of climate change adaptation and mitigation into EAs. However, no formal guidelines for climate change considerations are currently present in the Ontario Environmental Assessment Act or the Ontario Ministry of the Environment and Climate Change (MOECC) Codes of Practice Guidelines for EAs. Although no regulatory guidelines exist within the province, provincial authorities have identified climate change adaptation and mitigation as a priority, with the MOECC expressing an interest in updating the Codes of Practice Guidelines to include guidance for integrating climate change adaptation and mitigation into EAs (Government of Ontario, 2011). The province's *Climate Ready: Ontario's Adaptation Strategy and Action Plan for 2011-2014* has set integration of climate change into the Ontario EA process as one of the province's future goals, found in action item number 8 of the strategy (Government of Ontario, 2011). Climate change has also been noted as a priority within the new Provincial Policy Statement which was amended in 2014. Ontario's most recent vision of a low carbon economy is stated in the *2015 Ontario Climate*

Change Discussion Paper, "climate smart" infrastructure planning is stated as a requirement for meeting this vision (MOECC, 2015). Based on Ontario's strategic documents and policies, climate change adaptation and mitigation are priorities; however their integration into regulatory processes is not yet established. Thereby justifying the need for a framework specifically tailored to the Ontario context.

Various agents of the provincial government are delegated the responsibility of producing proactive climate change planning, both by formal delegation and by provincial inaction. The Ontario Climate Consortium (OCC) and the Toronto and Region Conservation Authority (TRCA), as agents for governmental concerns, have expressed interest in pursuing methods for integrating climate change adaptation and mitigation into EAs. The OCC provides a medium for the delivery of consistent climate information, climate risk assessment and adaptation across the province. It does this for various sectors that are vital to the economic development, social well-being, and health of the province's ecosystems (OCC, 2015). The Consortium has a number of partners (universities, municipal, provincial, and federal levels of government, conservation authorities, non-governmental organizations and the private sector) and its main focus is the delivery of proactive and effective climate change management.

The TRCA, as the secretariat to the OCC, develops approaches and coordinates projects that deal with climate change adaptation and mitigation in the Greater Toronto Area. Part of their work is to fund and, coordinate restoration projects and advocate for the development of green infrastructure. Green infrastructure acts as a tool for mitigating the impacts of climate change, while at the same time adapting to the anticipated impacts of climate change. A major antecedent to these projects is the completion of an EA.

To this effect OCC/TRCA engaged K-NEX Consulting to identify the existing best practices for the integration of climate change considerations into EA processes, and to develop a guidance document for specific application of climate change considerations into the Ontario EA process. It is the intention of OCC/TRCA to use this report to inform the integration of climate change considerations into EAs that fall under the Ontario EA process.

1.1 Report Description and Scope

Report Goal

The aim of this report is to inform upon the existing best practices for integrating climate change considerations into EA processes. Climate change considerations are discussed as adaptation and mitigation measures, with a focus on green infrastructure strategies. Specifically, the report will be addressing methods for integrating climate change considerations into the province of Ontario's current EA process, to reduce the impacts of infrastructure projects on climate change and reduce the vulnerabilities of infrastructure projects from the impacts of climate change. This goal is carried out through three primary components: a literature review, guidance document, and case study.

ADAPT to manage the unavoidable

MITIGATE to avoid the unmanageable

Report Description

The literature review provides a summary of the common themes regarding climate change, project planning, and EAs. Best practices regarding the integration of climate change considerations into EAs were extracted and refined from the identified common themes within the literature review. The guidance document is a practitioner guideline that provides a framework for EA practitioners to implement the identified best practices within the broad Ontario EA context. EA practitioners include those involved in the development of EAs and those who utilize EA documents. The practitioner guideline is a broad guidance document and is not a technical document informing on considerations for specific project types. While the ultimate goal would be to incorporate the suggestions for climate change integration into the Ontario EA Act, in the interim the guidance document provides broad recommendations for use alongside the Ontario EA Act. The guidance document is organized using the broad phases of the Ontario EA process. A case study is presented within the guidance document to provide an example of how the practitioner guideline can be applied to a planning project in Ontario. The case study is an additional resource for better understanding of the guideline. The City of Toronto's proposed Allen Road ToR is utilized as the case study. The case study analysis is used to evaluate the effectiveness and adaptability of the practitioner guideline in informing project planning. A project profile information sheet in Appendix A summarizes and highlights key findings of the literature review, guidance document and case study for informational and educational purposes.

Report Scope

Literature Review: *Best Practices for the Integration of Climate Change Adaptation and Mitigation into Environmental Assessments*

The literature review was scoped at three political levels; whereby literature searches were conducted at the provincial, national and international levels. Literature associated with the provincial (Ontario) and national (Canadian) levels was deemed of higher relevance and importance than international literature and findings.

Guidance Document: *Practitioner Guideline for the Integration of Climate Change Considerations into the Ontario Environmental Assessment Process*

The guidance document is broadly scoped for use alongside the Ontario EA Act. As such; the guideline is organized using the broad phases of the Ontario EA process for individual level EAs, and has been developed to inform the development of a project's Terms of Reference (ToR) and EA report. The practitioner guideline was additionally scoped to have the characteristics of flexibility and adaptability in order to be integrated into alternative and more specific EA processes such as streamlined Class EA process including the Ontario Conservation Authority Class EA process if desired. Class EAs are less comprehensive than individual level EAs and each Class EA type follows their own unique self-assessment and decision-making processes. The development of a highly specialized and technical guidance document informing specific project types was out of scope for this report.

Case Study:

The case study topic was scoped in consultation with the client. In meeting the request of the client, the case study focuses on an infrastructure project located within the Toronto Region.

Project Profile:

The project profile is a summary of the key highlights from the Literature Review, Practitioner Guideline, and Case Study for informational and educational purposes. The project profile is designed for web application and for print (Appendix A). Only the text for the project profile is provided, translation to web format is out of scope of this report.

1.2 Report Structure

Report Component	Description	Location in the Report
Main Report	Contains an introduction, description and scope of the report. Identifies the report structure. Provides analysis and final thoughts regarding the following components.	Currently within. Main report is distinguished with a grey colour scheme.
Literature Review	A summary of the common themes and existing best practices regarding climate change and project planning and EAs.	Stand-alone document at the end of the report. Literature Review is distinguished with a purple colour scheme.
Guidance Document (Practitioner Guideline)	A framework for EA practitioners to implement the identified best practices for the integration of climate change considerations within the broad Ontario EA context.	Stand-alone document at the end of the report. Guidance document is distinguished with a blue colour scheme.
Case Study	The City of Toronto's proposed Allen Road project ToR case study was utilized as an additional resource for better understanding of the guideline.	Component within the guidance document. (Appendix D of the guidance document)
Project Profile	A two page summary of the key findings and highlights of the literature review, guidance document and case study for informational and educational purposes.	Component within the main body of the report (Appendix A of the main report)

The literature review and guidance document are presented within this report as stand-alone documents at the end of the main report. The case study is included within the guidance document as an appendix. Analyses of the key findings of the literature review and guidance document are included within the main body of the report. The project profile is included as an appendix of the main report. The report conclusion with recommendations and next steps focus on the guidance document as it is the primary report component and is the resulting document from the best practices identified through the literature review.

2.0 Report Analysis

2.1 Literature Review Analysis

The goal of the literature review was to identify best practices for the integration of climate change adaptation and mitigation into EAs. Eight major themes were identified from a review of 63 documents. The eight major themes were identified as follows:

1) Relationship between Climate Change and Adaptation/Mitigation;
2) Green Infrastructure and its Relationship to Climate Change;
3) Existing Climate Change Adaptation and Mitigation Policies and Plans;
4) Existing Guidelines for the Integration of Climate Change Considerations into EAs;
5) Challenges and Barriers to the Integration of Climate Change Adaption Mitigation into EAs;
6) The Uncertainty of Climate Change and its Impact on the Successful Integration of Climate Change Considerations into EAs;
7) Importance of Stakeholder Engagement for the Integration of Climate Change Considerations into EAs; and,
8) Integration of Climate Change Considerations at Project Level and Strategic Level of EA.

Each theme provided novel information toward achieving this goal and has contributed to the identification of key points and best practices. A best practice was defined as a statement that informs an action that is deemed to be an effective and accepted method to achieve a desired goal. Best practices for the integration of climate change adaptation and mitigation into EA are actions that inform when and how a specific climate change consideration can be integrated into the existing regulatory process.

Key Points

The key points identified throughout the analysis of all 8 themes do not necessarily inform a specific action, but identify rationales for climate change integration into EAs and provide justification for best practices.

1) Adaptation and Mitigation: Regulatory frameworks can build capacity to address and adopt adaptation and mitigation measures.

2) Green Infrastructure: Climate change considerations, such as green infrastructure, should be integrated into the EA process because EAs provide a means to ensure that the resultant benefits to infrastructure are obtained.

3) Existing Plans and Policies: Efforts to address climate change are being made at local levels; EAs should engage with the existing efforts at this level.

4) Existing Guidelines: Climate Change considerations can be integrated into EAs through the use of principles and existing EA legislative requirements.

5) Challenges: Major challenges inhibiting the integration of climate change into EA include: uncertainty, stakeholder engagement, project and strategic level scoping.

6) Climate Change Uncertainty: If proponents follow guidelines regarding best practices for integrating climate change considerations, then uncertainty can be addressed in tandem.

7) Stakeholder Engagement: Stakeholder engagement can be considered to be either a benefit or a challenge to successful integration of adaptation and mitigation into EAs.

8) Project and Strategic Level EA: Climate change should be addressed at both the project and strategic level to ensure complete integration into planning. Guidance documents may provide the quickest approach to integrating climate change considerations into EAs.

Best Practices

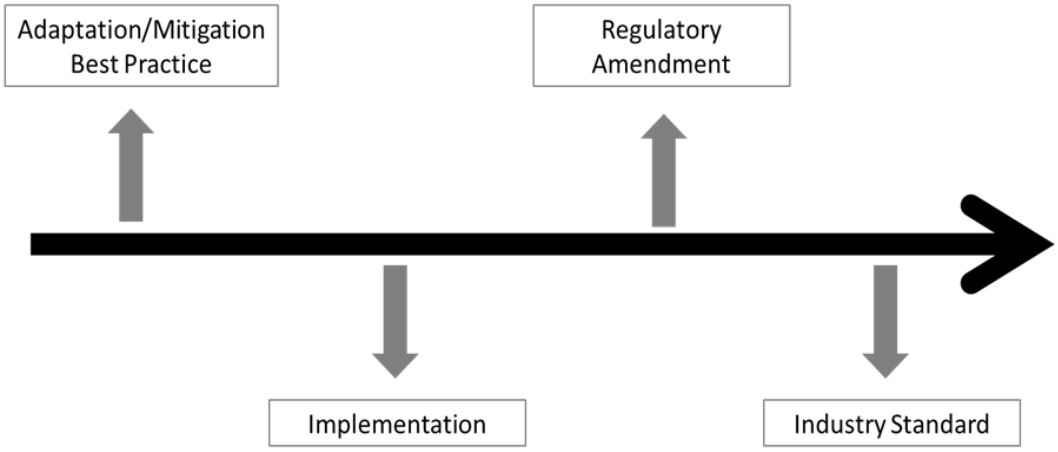
Best practices can be utilized to apply climate change considerations within EA and can inform the creation of a guidance document. In theme 7 *Climate Change Uncertainty*, guidance documents are identified as the fastest means to integrate climate change considerations into the EA process. Best practices were identified through the analysis of themes and therefore are not presented within the text of the literature review in chronological order of their intended application. Refer to Appendix B for a consolidated list of best practices, identified and modified throughout the literature review, in their intended chronological use throughout the EA process.

Guidance Documents as Implementation Tools

Ontario's strategic documents indicate that climate change adaptation and mitigation are priorities; however the integration of climate change considerations into regulatory processes is not yet established. As identified in Theme 7, *Project and Strategic Level EA*, guidance documents may provide the quickest approach to integrate the best practices into EA processes.

The relationship between climate change and adaptation/mitigation best practices further strengthens the usefulness of guidance documents. The process for the establishment of adaptation/mitigation practices as an industry standard follows the timeline identified in Figure 1.

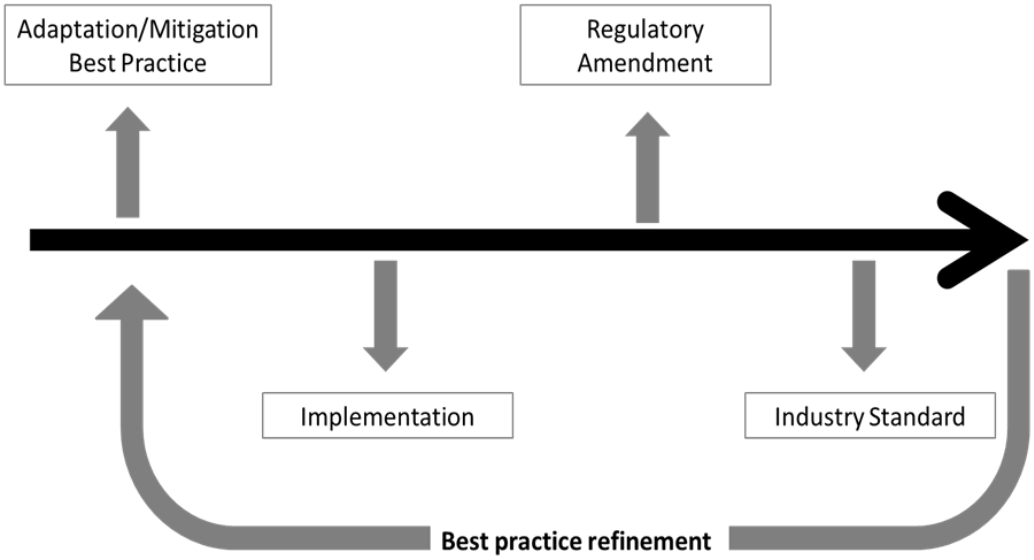
Figure 1. Timeline for the Establishment of Adaptation/Mitigation Best Practices as Industry Standards



Best practices are identified and then implemented on a small scale. It is not until regulations are amended, and the use of the best practice becomes a law, that the best practice becomes the industry standard. Once an industry standard, it is the minimum requirement for any new project.

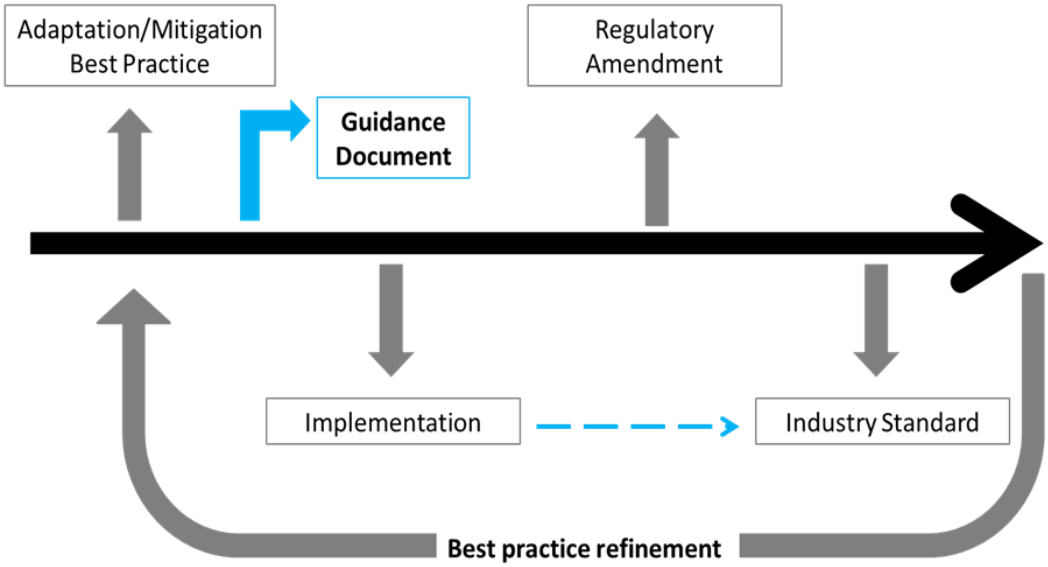
When climate change is considered, best practices need to be refined at a faster rate than regulations can be amended as shown in Figure 2.

Figure 2. The Integration of Best Practice Refinement into the Adaptation/Mitigation Timeline



This is because climate change can cause shifts in climatic parameters that can render the best practice ineffective. In order to keep up with the rate of climatic changes, and therefore best practice refinement, guidance documents can be utilized. Guidance documents provide information regarding how a best practice, or a set of best practices, can be implemented. This will result in the ability to by-pass regulatory change and establish the best practice as the industry standard, shown in Figure 3.

Figure 3. Guidance Documents as Method to By-Pass Regulatory Amendments for Establishment of Adaptation/Mitigation Best Practices as Industry Standards



A guidance document for the integration of adaptation and mitigation considerations into the Ontario EA process should establish a set of best practices and provide information regarding how they can be implemented. The ultimate goal is that the integration of the best practices into EAs becomes part Ontario's required EA process, allowing for these best practices to become the industry standard. In the interim guidance documents will provide a means for climate change considerations to be integrated into the EA process prior to regulatory amendment.

2.2 Practitioner Guideline Analysis

Creation of the guidance document was informed by best practices for integrating climate change considerations in EA planning identified through the literature review. The guidance document created was a practitioner guideline for the integration of climate change considerations into the Ontario EA process. The structure of the guideline was informed by the findings from the literature review and by the broad phases required in an EA in Ontario. The Allen Road ToR case study was used as an example of how to apply the guidance document to a project, providing an educational tool to improve EA practitioner understanding of the guideline.

The case study example was utilized to determine the adaptability and effectiveness of the practitioner's guideline developed by K-EX Consulting. The case study provides an analysis of the adaptability of the guideline because the Allen Road document reviewed was a ToR, not a completed EA. The practitioner's guideline can be a useful tool for the ToR stage if properly utilized to inform the subsequent stage of the EA process. If the guideline is considered effective, then it has also been proven to be adaptable in the manner described. To test the complete adaptability of the practitioner's guideline, multiple case studies would need to be conducted.

The practitioner's guideline is considered effective if the:

1. considerations identified in the guideline can be applied to the EA;
2. integration of considerations into each phase can be clearly disseminated in written form to the reader;
3. application of the guideline provides novel information or frames existing information in a new and useful way; and,
4. application of the guideline can inform next steps for the practitioner.

Are the considerations identified in the guideline applicable to the EA?

The phases and considerations identified in the guideline are comparable to the components of the Allen Road ToR. Each phase identified had information that could be applied to the components of the ToR. Given that the case study was a ToR and not a completed EA, the components were the most directly comparable to Phase 1, *Statement of Purpose and Initial Considerations,* of the practitioner's guideline. It is anticipated that if a case study was conducted using a completed EA, the phases of the guideline would be directly comparable to the phases of the EA.

Can the integration of considerations into each phase be clearly disseminated in written form to the reader?

The process required to produce a written documentation of how the considerations identified in the guideline could be applied to case study was not overly complicated. The guideline is framed

in such a way that it provides prompting questions and worksheets for ease of use and therefore ease of communication.

EXAMPLE

Phase 1.1 Step 2 prompts the practitioner to,

> Identify if there is potential for climate change to impact the project's:
> 1) intended effect on society;
> 2) intended purpose; ability to solve or alleviate the identified issue; and,
> 3) ability to pursue the identified opportunity.

This prompt directly results in the analysis that,

> while climate change is not stated as the direct rationale for the project, climate change considerations may impact the project's intended purpose (Phase 1.1, Step 2) as both an improved transportation corridor and as a project to reduce the impacts of the road on the local community.

Does the application of the guideline provide novel information or frame the existing information in a new and useful way?

The guideline was successful in framing the content of the ToR in such a way that it provided the practitioner with novel and useful information.

EXAMPLE

The use of the guideline's Appendix B-2 Worksheet 3, *Impacts of Climate Change Parameters on the Project, and Impacts of the Project on Climate Change Parameters*, resulted in the identification of project vulnerabilities at this early stage in the EA process. Information used to populate this worksheet was taken from various parts of the ToR and was synthesized to enable the practitioner to better understand how to identify vulnerability, and what vulnerabilities may be present prior to conducting an in depth analysis. This will enable the practitioner to further develop an understanding of vulnerabilities through a focused lens.

Does the application of the guideline inform next steps for the practitioner?

The benefit of utilizing a ToR as a case study is that the guideline can be used as a guide for next steps when conducting the subsequent EA document. Of particular importance of the completion of the EA is the identification and evaluation of VECs. The ToR did not identify VECs, therefore the guideline could be utilized to inform next steps and therefore ensuring the integration of climate change during EA scoping which is an integral part of the EA process. It is anticipated that if the case study were a completed EA, the guideline would provide practitioners with next

steps specifically in regard to Phase 3, *Identifying Significant Impacts*, and the creation of climate change scenarios, scenario analysis and risk assessment production.

EXAMPLE

The guideline identified these important considerations for next steps.

Worksheets 1 and 2 of Appendix B-1 can be utilized to scope boundaries once VECs are determined.
Worksheet 1 (Appendix B-1) focuses on scoping VECs. If groundwater contamination is an identified VEC, the spatial boundary of the project's impact may need to be increased past the original project boundary. This will address the increased potential for groundwater contamination due to climatic factors.

Worksheet 2 (Appendix B-1) focuses on scoping the boundaries of the environment types and identifying any additional VECs associated with the boundary changes. If built infrastructure is negatively impacted by extreme weather events, the temporal boundary of the built environment may need to be changed. If climatic conditions worsen, the road infrastructure may need reassessment prior to the 25 year lifespan based on the current climate.

The answer to each of the identified success criteria for the case study was yes in Figure 4. The Allen Road ToR case study therefore successfully indicates that the practitioner's guideline is effective.

Figure 4. Checklist for the Determination of an Effective Guidance Document

Requirement	**Success**
Are the considerations identified in the guideline applicable to the EA?	✓
Can the integration of considerations into each phase be clearly disseminated in written form to the reader?	✓
Does the application of the guideline provide novel information or frame the existing information in a new and useful way?	✓
Does the application of the guideline inform next steps for the practitioner?	✓

The case study was utilized as an example of how the guideline can inform project planning in Ontario. As an informative demonstration, the case study can be studied to improve EA practitioner understanding of the practical application of the guideline. Due to the case study being a ToR, the practitioner guideline was able to demonstrate points for integration of climate change considerations prior to the proponent's completion of the EA.

3.0 Conclusion

3.1 Recommendations

The literature review was conducted to identify the relevant best practices for the integration of climate change adaptation and mitigation into EA. Guidance documents are recommended as a best approach to integrate the best practices identified into the Ontario EA process. The practitioner guideline was produced as a reflection of this recommendation, and should be applied to projects under the Ontario EA Act.

It should be noted that the recommended application of the guideline to all existing and future Ontario EA projects is necessary, but not sufficient to produce a system that has reached a complete integration of climate change considerations into planning. To produce a truly proactive planning system within Ontario, climate change should be addressed at both the project and strategic level.

3.2 Next Steps

More case studies should be utilized to determine the extent of the practitioner guideline's adaptability. The case study determined the adaptability of the guideline as a useful tool in the ToR phase. For further analysis of adaptability, case studies should be utilized from Class EAs, such as the Municipal Class EA and the Conservation Authority Class EA. Additionally, an attempt should be made to utilize case studies for different types of projects such as; sewage and water (municipal service), transportation (infrastructure) and waterfront/watershed - (erosion/sediment control). Case studies should utilize the framework for analysis identified above and the checklist provided in Figure 4. If any of the requirements are not met, then the practitioner's guideline should be modified to meet the requirements.

The practitioner guideline should be used as a framework to create technical guidance documents that are specific to project types. These documents should follow the same general outline of the practitioner guideline and should be compared against case studies to determine their effectiveness. If required, the criteria for success should be modified from Figure 4 to reflect more specific requirements of the technical guidance document. Each phase of the EA should be presented with a brief explanation and a reference to the relevant section of the relevant legislation. This will differ depending on if the technical guideline is for the Municipal Class EAs or the Conservation Authority Class EAs. Each phase could outline the specific regulatory requirements for the given project type within the identified EA type. Additionally, within each phase, specific information regarding the inclusion of green infrastructure measures can be provided. For example, if the project is an erosion control Municipal Class EA, then mitigation and adaptation measures specific to erosion control should be identified and directions provided for integration.

Climate change should be addressed at both the project and strategic level to ensure complete integration into planning. Steps should be taken to provide planning guidance for Strategic Environmental Assessment. This next step should not be taken after the completion of the first two identified next steps, but rather should be in conjunction with climate change integration into project EAs.

3.3 Final Thoughts

The impacts of climate change are apparent and place stress on the natural, built, economic, social, and cultural, environments. A proactive approach is necessary to integrate climate change considerations (adaptation and mitigation) into the planning process. This can be done through the EA process. The EA process as a regulatory process is difficult to amend and therefore the fastest method for integration is a practitioner guideline. If Ontario is able to successfully adopt a guideline for the integration of climate change considerations into EAs, practitioners will be provided with the necessary tools to develop a proactive planning practice.

4.0 References

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Appendix A Project Profile

The project profile is a summary of the key highlights from the Literature Review, Practitioner Guideline, and Case Study. The project profile is designed for web application and for print purposes. An image of the project profile is below.

Best Practices for the Integration of Climate Change Adaptation and Mitigation into Environment Assessments

Climate change impacts are beginning to manifest locally and globally, and Ontario's social and economic foundations will need to adapt to this changing climate. Currently, Ontario's infrastructure is vulnerable to erosion and flooding events, resulting in high socio-economic costs. Early climate change planning can aid in reducing this vulnerability.

Climate change is becoming an acknowledged area of concern in Environmental Assessment (EA) planning, and the need to incorporate climate change into EA processes is being discussed. Currently, no formal guidelines for climate change considerations are present in the Ontario Environmental Assessment Act. A literature review was conducted in order to determine relevant considerations and best practices for the integration of climate change adaptation and mitigation into EAs. In addition to this, a guidance document was created to provide recommended steps and considerations for the integration of climate change considerations into the

The project was completed by K-NEX Consulting, a student group from Western University within the Masters of Environment and Sustainability program. The project was prepared for the Ontario Climate Consortium and the Toronto and Region Conservation Authority. K-NEX Consulting members are Kirstin Geissler, Natalie Schott, Emamoke Dare, and Xueqi Zhang.

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LITERATURE REVIEW

The literature review identified 8 major themes regarding the integration of climate change adaptation and mitigation into EAs.

1 Adaptation and Mitigation
Regulatory frameworks can build capacity to address and adopt adaptation and mitigation measures.

2 Green Infrastructure
EAs provide a means to ensure that the resultant benefits to green infrastructure are obtained.

3 Existing Plans and Policies
Efforts to address climate change are being made at local levels; EAs should engage existing efforts at this level.

4 Existing Guidelines
Climate change considerations can be integrated into EAs through use of principles and existing EA legislative requirements.

5 Challenges
Challenges inhibiting integration of climate change into EA include: uncertainty, stakeholder engagement, project and strategic level scoping.

6 Uncertainty
Uncertainty can be addressed while following guidelines regarding best practices for integrating climate change considerations.

7 Stakeholder Engagement
Stakeholder engagement can be considered a benefit or a challenge to integrating climate change considerations.

8 Project and Strategic Level EA
Climate change should be addressed at both the project and strategic level to ensure complete integration into

GUIDANCE DOCUMENT

Phase 1 Statement of Purpose and Initial Consideration
- Consider whether the project in response to an extreme event and/or can be undertaken to reduce GHG emission
- Identify potential climate change impacts on the project
- Explore feasible alternatives that consider climate change

Phase 2 Scoping
- Identify project boundaries and how climate change impacts these boundaries
- Modify project boundaries accordingly
- Determine valued ecosystem components (VEC), in light of modified project boundaries
- Integrate climate change concerns raised by regulators, stakeholders and public

Phase 3 Identifying Significant Impacts
- Determine the potential impacts of climate change on the project (i.e. GHG emissions)
- Conduct climate change scenario analysis to determine the need for a risk assessment
- Complete a risk assessment if necessary (requires stakeholder involvement)

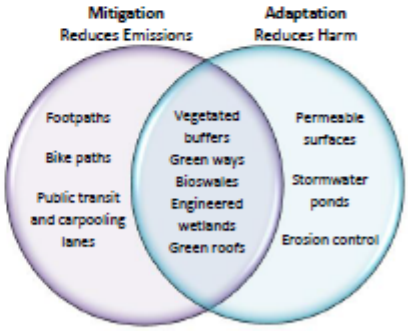
Phase 4 Cumulative Impacts
- Conduct a Cumulative Impact Assessment
- Involve stakeholders to continuously address the changing environment
- Utilize network analysis to identify the interrelationships between causes and effects

Phase 5 Impact Management
- Explore adaptation and mitigation measures
- Utilize degree of confidence in climate projections, risk assessment and stakeholder considerations to determine the extent of adaptation and mitigation measures

Phase 6 Monitoring and Commitments
- Create an Adaptive Management framework and an adaptive management plan
- Address relative technology, policy and legislation changes with regards to climate change
- Engage stakeholders continuously

EA regulations are difficult to develop and amend. Guidance documents may provide the quickest approach to integrating climate change within EAs.

The intended use of the guidance document is to inform EA practitioners on best practices for the integration of climate change considerations into project EAs. The document provides an opportunity for users to identify potential vulnerabilities and verify the resilience of their projects. It allows practitioners to address climate change threats that are unique to their region through existing tools and technologies. Due to the broad nature of the guidance document, it can be utilized further to inform the development of technical guidance documents and can be integrated within class EA processes such as the Conservation Ontario Class EA or the Municipal Class EA.



CASE STUDY The City of Toronto's proposed Allen Road Terms of Reference (ToR) was utilized as a case study to determine the effectiveness and adaptability of the guidance document. Due to the case study being a ToR, the guidance document was able to demonstrate points for integration of climate change considerations when the proponent completes an EA. A key point of integration identified is the comparison of design alternatives based on relative GHG emission contributions and adaptation and mitigation measures in the project designs.

Appendix B Best Practices

Best Practice 1: Climate change considerations and adaptation and mitigation measures should be identified and integrated directly into all phases of the EA process. Proponents should avoid creating a separate document dedicated to climate change.

Best Practice 2: The consideration of climate change adaptation and mitigation should be addressed as an aspect of the project description, regardless of existing regulatory guidelines, and should consider all current climate change policies that are relevant within the project's jurisdiction.

Best Practice 3: When determining the impacts of the project, the EA should address, the potential impact of climate change on the project; and the potential impact of the project on climate change (greenhouse gas emissions).

Best Practice 4: When determining the impacts of the project on climate change, clearly defined qualitative and quantitative data should be provided regarding GHG emissions, over the life-time of a project. The emissions should be compared against regional government or industry reduction targets, not national rates of emissions. Significance of GHG emissions should be determined using a reasoned argumentation approach that integrates scientific and local knowledge with qualitative and quantitative data.

Best Practice 5: When identifying the impacts of the project on climate change, and the impacts of the environment of the project, at least three climate change projections should be produced using the best scientific information. These projections should be based on an assessment of the baseline environment and scenario analysis beyond simple historical climate data that includes scientific, local and traditional knowledge.

Best Practice 6: Risk assessment approaches should be utilized for effective decision making when determining the significance of identified impacts. Risk assessment approaches and climate change predictions should be supplemented with explanation and justification for decisions, including reference to the degree of confidence held and uncertainty held.

Best Practice 7: Climate change adaptation and mitigation measures should be considered based on a life-cycle assessment of the project when addressing impacts of the project on climate change, and the impacts of the environment of the project.

Best Practice 8: EAs should utilize strategies, such as green infrastructure, that accomplish both adaptation and mitigation when attempting to manage the impacts of a project.

Best Practice 9: Decisions regarding the application of climate change adaptation and mitigation practices, during impact mitigation efforts, should be based on the precautionary principle of "do no harm".

Best Practice 10: The extent of adaptation and mitigation measures proposed for any project should depend of the extent of uncertainties regarding climate change impacts and future impact to climate change determined during the EA of the project.

Best Practice 11: If a project is deemed vulnerable to climate change an adaptation or 'adaptive management' plan should be produced that is focused on risk reduction, the application of no regrets measures, the long-term nature of climate change, and the uncertain nature of climate-change.

Best Practice 12: Stakeholder knowledge of climate change should be considered, throughout all phases of the EA process. The best available climate change knowledge should be utilized when determining climate change scenarios, the impacts of climate change on the project and impacts of the project on the climate.

Best Practice 13: Prior to the initiation of the EA, a stakeholder engagement process should be created that is focused on understanding climate change and uncertainty and promoting opportunities for positive engagement.

Best Practice 14: Throughout stakeholder engagement exercises, EA practitioners should encourage and work with local organizations pursuing adaptation and sustainability strategies.

Best Practice 15: Address uncertainty early within the process and continually re-evaluate the vulnerability of the project throughout its lifecycle.

Document 1

Literature Review of the Best Practices for the Integration of Climate Change Adaptation and Mitigation into Environmental Assessments

Prepared for

Ontario Climate Consortium | Toronto Region Conservation Authority (TRCA)

Prepared by

K-NEX Consulting

Connecting you to a sustainable future

April 14, 2015

The following literature review was authored by K-NEX Consulting. The development of this literature review was commissioned by the Toronto and Region Conservation Authority (TRCA) as secretariat of the Ontario Climate Consortium (OCC).

Literature Review Table of Contents

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1.0 Introduction

Climate change is becoming an acknowledged area of concern in Environmental Assessment (EA) planning, and the need to incorporate climate change adaptation and mitigation into the phases of EA processes is being discussed across international, and Canadian federal and provincial, regulatory bodies. The United Nations Framework on Climate Change Convention (UNFCC), an international convention comprised of 195 nations joined in an effort to address climate change challenges, mandates that, "all Contracting Parties have responsibilities to take climate change into account… to minimize adverse effects on the economy, public health, and quality of environment, in projects or measures undertaken to mitigate or adapt to climate change" (Sok, Boruff & Morrison-Saunders, 2011, p.18). As a contracting party, Canada is required to uphold the convention commitments (Government of Canada, 2012). This international perspective on climate change mitigation and adaptation is reflected in the Canadian policy context.

Within the federal domain, the Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment (FPTCCCEA) is a leader in the development of guidelines for EA development. The Committee recognizes that when, "the risks associated with the impacts of climate change on a project are of a private sector nature alone, the proponent can choose to absorb this risk. However, if climate change risks extend beyond the project itself to potentially affect the public or the environment, this information must be factored into an informed decision by relevant authorities" (FPTCCCEA, 2003, p.13). The FPTCCCEA prescribes the use of the EA process to inform decisions. This process should also recognise the effect of green infrastructure on mitigation and adaptation strategies. The value of green infrastructure is now being recognised as one of the adaptation and mitigation means to address the impacts of climate change (Foster, Lowe, & Winkelman, 2011).

The Ministry of the Environment (MOECC) and the Government of Ontario are in the initial stages of creating a legislative framework for the integration of climate change adaptation and mitigation into Ontario EAs. Currently, no formal guidelines for climate change considerations are present in the Ontario Environmental Assessment Act or the (MOECC) Codes of Practice Guidelines for EA (*Consultation in Ontario's Environmental Assessment Process, Preparing and Reviewing Environmental Assessments in Ontario, Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario*) (MOECC 2014a; MOECC, 2014b; MOECC, 2014c). Although no regulatory guideline within the province exists, provincial authorities have identified climate change adaptation and mitigation as a priority, with the MOECC expressing an interest in updating the Codes of Practice Guidelines to include guidance for integrating climate change adaptation and mitigation into EAs (Government of Ontario, 2011). The province's *Climate Ready: Ontario's Adaptation Strategy and Action Plan for 2011-2014* has set integration of climate change into the Ontario EA process as one of the province's future goals, found in action item number 8 of the strategy (Government of Ontario, 2011).

Climate change has also been noted as a priority within the new Provincial Policy Statement (PPS), amended in 2014. The statement is a strategic level document providing province-wide direction for all future policy development regarding land use planning, the environment, and the economy (Ministry of Municipal Affairs and Housing, 2014). The PPS addresses climate change considerations by promoting planning and design that incorporates green infrastructure, energy conservation, greenhouse gas reduction and climate change adaptation.

In sections 1.6.1, 1.6.2 and 1.8.1 the PPS identifies,

> 1.6.1: Infrastructure, electricity generation facilities and transmission and distribution systems, and public service facilities shall be provided in a coordinated, efficient and cost-effective manner that **considers impacts from climate change** which accommodating project needs.
> 1.6.2: Planning authorities should **promote green infrastructure** to complement infrastructure.
> 1.8.1: Planning authorities shall **support energy conservation** and efficiency, improved air quality, **reduced greenhouse gas emissions**, and **climate change adaptation** through land use and development patterns... (MMAH, 2014).

Climate change adaptation and mitigation are priorities for the Government of Ontario. The Climate Ready Action Plan and PPS place climate change considerations as a strategic goal, and have made recommendations for its integration into regulatory processes. The MOECC has identified a desire to update the Ontario EA to reflect this priority and adhere to these recommendations. Methods for integrating climate change adaptation and mitigation into the Ontario EA process have not been identified, therefore justifying the need for a review of best practices.

2.0 Methodology

The literature review was conducted in a semi-structured manner and explored three levels of relevant literature from international, national and provincial sources. The literature review targeted the following sources: academic, Canadian municipal, provincial and federal governmental bodies, conservation authorities, and not-for-profit and non-governmental organizations. International level literature focused on searches through academic sources. A range of documents were reviewed, including: implemented technical guidance documents, strategies and policies, case studies and theoretical academic critiques of best practice methodologies, and academic review papers. Documents were chosen based on relevance to the topic, "Best Practices for the Integration of Climate Change into EAs".

Major themes were identified from the review of the literature. Themes were utilized to determine the breadth and focus of the literature subject material. Each theme is presented in Section 3. The goal of the literature review is to identify best practices for the integration of climate change adaptation and mitigation into EAs. Identification of best practices follows, and is derived from, a summary of each theme. A best practice is defined as a statement that informs an action that is deemed to be an effective and accepted method to achieve a desired goal. Best practices for the integration of climate change adaptation and mitigation into EA are actions that inform when and how a specific climate change consideration can be integrated into the existing regulatory process.

3.0 Major Themes

The eight major themes identified from a review of 63 documents are:

1) Relationship between Climate Change and Adaptation/Mitigation;
2) Green Infrastructure and its Relationship to Climate Change;
3) Existing Climate Change Adaptation and Mitigation Policies and Plans;
4) Existing Guidelines for the Integration of Climate Change Considerations into EAs;
5) Challenges and Barriers to the Integration of Climate Change Adaptation Mitigation into EAs;
6) The Uncertainty of Climate Change and its Impact on the Successful Integration of Climate Change Considerations into EAs;
7) Importance of Stakeholder Engagement for the Integration of Climate Change Considerations into EAs; and,
8) Integration of Climate Change Considerations at Project Level and Strategic Level of EA.

3.1 Relationship between Climate Change and Adaptation/Mitigation

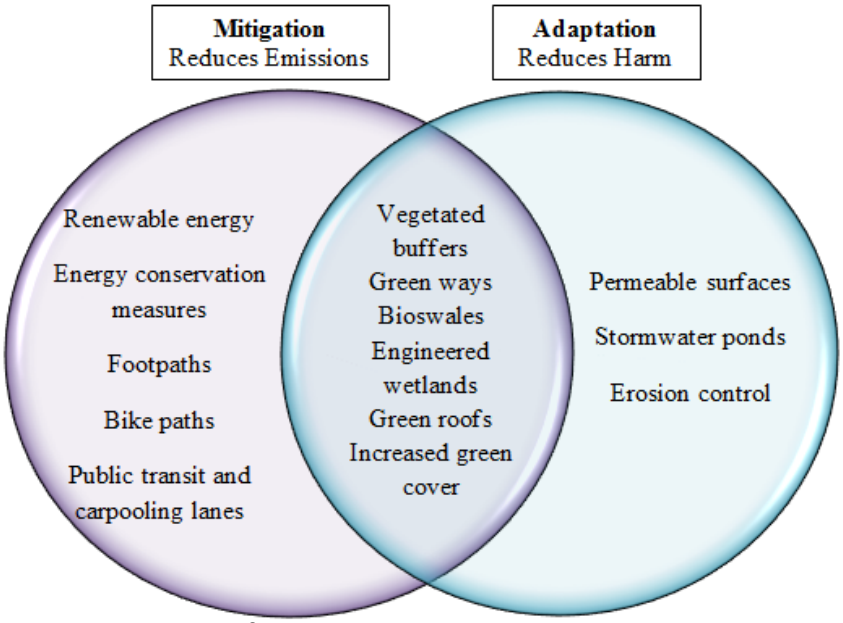
The UNFCC recognizes adaptation and mitigation as essential responses to climate change (Burton, 2000). Mitigation refers to any action taken to reduce greenhouse gases (GHGs), slowing the rate of climatic change. According to the Intergovernmental Panel on Climate Change, adaptation is defined as an "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (Pachauri & Reisinger, 2007, p.869). The main goal of adaptation is to alleviate and reduce current sensitivity and vulnerability to climate-related crises to increase resiliency of communities (Natural Resources Canada, 2008). The adaptive capacity of a given institution, individual or community to implement adaptation measures is increased through the creation of frameworks tailored specifically to the issue, particularly legislative frameworks such as EA processes (Byer, Colomobo, Sabelli, & Ches, 2011).

KEY POINT

Adaptation and Mitigation
Regulatory frameworks can build capacity to address and adopt adaptation and mitigation measures.

While there is a distinction between mitigation and adaptation, these two terms can also be inter-related. Mitigation moderates the magnitude and rate of climate change, affecting the demands for extensive adaptation under greater magnitudes of changes (NRC, 2008). Certain strategies can be considered to be both mitigative and adaptive (Figure 1). Bizikova, Robinson and Cohen (2007) express that the optimal pathway for sustainable development is through the integration of both mitigation and adaptation, specifically strategies that address both in tandem.

Figure 1. Linkages between Mitigation and Adaptation



(Figure adapted from Penney, 2008)

Key Findings and Best Practices

This theme demonstrates that adaptation and mitigation measures are an important component of building local and institutional capacity. Institutional capacity can be developed through regulated legal frameworks, such as the EA process. The characteristics of adaptation and mitigation, such that there are strategies that can accomplish both, inform a best practice. EAs should utilize strategies, such as green infrastructure, that accomplish both adaptation and mitigation when attempting to manage the impacts of a project.

BEST PRACTICE

EAs should utilize strategies, such as green infrastructure, that accomplish both adaptation and mitigation when attempting to manage the impacts of a

3.2 Green Infrastructure and its Relationship to Climate Change Adaptation and Mitigation

The literature review identified three findings regarding the relationship between green infrastructure and adaptation and mitigation planning. Stormwater management is a major concern for Ontario's infrastructure system. A majority of references to green infrastructure originated from documents pertaining to municipalities and conservation authorities' use of green infrastructure as a planning strategy. Lastly, our literature review identified that the benefits of green infrastructure can be utilized as a justification for the inclusion of climate change considerations within the EA process (MMAH, 2009; Foster et al., 2011; Federation of Canadian Municipalities, 2009).

Stormwater Management as Major Ontario Infrastructure Concern

The literature review determined that stormwater management is Ontario's major climate change related infrastructure concern. Over the last fifty years there has been a significant change in the precipitation patterns in Canada, with an overall national increase of 12% (Toronto and Region Conservation Authority, 2009). Historical data indicates that the province of Ontario is experiencing shifts in seasons, with shorter winters, earlier springs, and more intense precipitation events (MOECC, 2015). The main climate change impact to infrastructure in Ontario is from storm events, resulting in the need for strategic planning for stormwater infrastructure. The literature review identified the 2013 flood event in the City of Toronto as a primary example of the current inadequacy of stormwater management and a need within the province to adapt to climate change (Toronto Water, 2013; Environment Commissioner for Ontario, 2014). In this event, the wastewater and stormwater treatment facilities were overwhelmed and could barely cope with the loads (Toronto Water, 2013). It is reported that as a result of this overwhelm, "up to a billion liters of sewage as well as garbage and debris were washed into Toronto's rivers and Lake Ontario" (ECO, 2014, p.2).

Canadian Municipalities and Conservation Authorities Focus on Green Infrastructure

Green infrastructure is often related to environmental or sustainability goals that municipalities are trying to achieve through a mix of approaches (Foster et al., 2011). Green infrastructure, as a broad umbrella term, involves the use of natural vegetation and vegetative technologies in conjunction with traditional infrastructure to provide environmental, social and economic benefits (Green Infrastructure Ontario Coalition & Ecojustice, 2012; TRCA, 2007). Municipalities already design, manage, and operate their own infrastructure and can therefore provide the essential human resources required for identifying climate-related challenges and recommending adaptive or remedial actions. A current push for green infrastructure investment and planning initiatives that were not previously a focus of municipal planning has been identified through an examination of municipalities' published reports. According to the Planning and Economic Development Committee (2011), current efforts to address climate change through infrastructure planning are largely attributed to the fact that traditional infrastructure design standards no longer produce infrastructure resilience in the context of climate change.

Implementing green infrastructure as a planning strategy has been applied by a number of municipalities, including Kitchener/Waterloo, Ottawa, London, Toronto, Stratford, Collingwood, Welland, and Markham in Ontario (Kovacs, Guibault & Sandink, 2014). Kovacs et al., (2014), have compiled a book of case studies looking at Canadian municipalities that are leaders in infrastructure planning, particularly those that adapt to and mitigate the effects of climate change. Additionally, the Ministry of Municipal Affairs and Housing (MMAH) has created a guidance document outlining the common existing planning tools with which municipalities can plan for developing green infrastructure (MMAH, 2009). Examples of common existing planning tools being: Official Plans, Community Improvement Plans, and Zoning By-laws.

Municipalities and conservation authorities are responding to climate change by putting in place Climate Change Adaptation Plans that can be integrated into existing plans and programs. There is, however, no single approach to climate change adaptation that is appropriate for all communities, as each has to deal with geographically unique climate issues, in addition to legal systems, institutions and societal values that differ by region (FCM, 2009; Richardson, 2010). Bearing this in mind, it is therefore imperative for municipalities to investigate and understand the specific risks related to their communities and for conservation authorities to determine the risks for their jurisdiction.

Many municipalities across Canada are utilizing climate change adaptation plans and strategies to address specific aspects of climate change. Richardson (2010) documents examples of some of these plans:

1. Edmonton's Urban Forest Management Plan
   The goal of the Edmonton Forest Management Plan is to effectively manage, sustain and ensure the growth of the urban forest, to stress the importance of urban forests and to protect native forests. The city has 299,000 landscape trees on City property and these trees provide valuable ecological services to the City. They keep neighbourhoods cool, improve air quality, provide wildlife habitat, remove carbon dioxide from the atmosphere, retain stormwater run-off and prevent erosion (NRC, 2010a).

2. London, Ontario's, Climate Change Adaptation Strategy (reducing flood risk through proactive design)
   The goal of London, Ontario's, Climate Change Adaptation Strategy is to reduce flood risk through proactive designs. This plan demonstrates that the City is moving towards an ecological/systems approach to stormwater management (NRC, 2010b; Richardson, 2010)

3. Toronto's Heat Health Alert System
   The goal of Toronto's Heat Health Alert System is to protect the most vulnerable populations from extreme heats and cold (NRC, 2010c).

Additionally, Ontario's conservation authorities are taking a lead in creating climate change adaptation plans to address the unique issues within their own jurisdictions. Some of the conservation authorities' adaptation plans are listed below:

1. TRCA Action Plan For The Living City
   TRCA's goals for the Living city are to build a sustainable community with healthy rivers and shorelines, green space and biodiversity in addition to business excellence. The TRCA identifies that integrating climate change will be a critical component in achieving the objectives and goals of a healthy, sustainable urban region extending into the 22nd century (TRCA, 2007).

2. Hamilton Conservation Authority (HCA) Strategic plan 2014-2018
   The goal of the HCA Strategic Plan is to chart the course for HCA to continue to safeguard and enhance the water, natural environment and recreational facilities for the benefit of the City of Hamilton and Township of Puslinch's long term environmental, social and economic prosperity (HCA, 2013)

3. Lake Simcoe Region Conservation Authority (LSRCA) Comprehensive Stormwater Management Master Plan
   The LSRCA Comprehensive Stormwater Management Master Plan provides direction to municipalities on how the Lake Simcoe Protection Plan objectives will be achieved through the effective management of stormwater within existing and expanding settlement areas (LSRCA, 2011).

The Benefits of Green Infrastructure Justifies its Use in the EA Process

The value of green infrastructure is that it provides an opportunity to adapt to climate change. The application of green infrastructure in urban areas is regarded as a realistic integration method that can significantly contribute to reduced carbon emissions and avoidance of climate hazards (Foster et al., 2011). Climate change is a key aspect of infrastructure planning. If infrastructure planning does not account for climate change, it will not be sustainable. Green infrastructure is an effective and multi-beneficial approach to address climate change and develop sustainable infrastructure. EAs provide a framework to ensure the application of green infrastructure, and as a result EA projects that can withstand climate change.

KEY POINT

Green Infrastructure
Climate change considerations, such as green infrastructure, should be integrated into the EA process because EAs provide a means to ensure that the resultant benefits to infrastructure are obtained.

Key Findings and Best Practices

This theme highlights that Ontario planning strategies have a focus on stormwater management, green infrastructure is primarily a concern of municipalities and conservation authorities, and the benefits of green infrastructure provide a justification for its use in EA. No best practice is directly linked to this theme. This is because this theme presents a rationale as to why climate change considerations should be integrated into EA. It does not however, present an action regarding how and when climate change considerations should be integrated into the EA process. Climate change considerations, such as green infrastructure, should be integrated into the EA process because EAs provide a means to ensure that the resultant benefits to infrastructure are obtained.

3.3 Existing Climate Change Adaptation and Mitigation Policies and Plans

The literature review identified 12 documents, ranging from the international to national level, that address the incorporation of climate change considerations into existing policies and plans. Eight of these documents are related to Canadian context directly, showing strong evidence that local government and organizations take climate change scenarios into consideration when directing adaptation actions (Penney & Wieditz, 2007; Burch, 2010; Binstock, 2011; Foster et al., 2011; Lemieux & Scott, 2011; Mees & Driessen, 2011; Canadian Institute of Planners, 2012; Mees, Driessen, Runhaar & Stamatelos, 2013).

International Adaptation and Mitigation Policies

In the international arena, European countries are acting as pioneers in the reduction of GHG emissions, particularly through ambitious policies (Schreurs & Tiberghien, 2007). These policies focus on energy conservation and efficiency and promote green city designs (Penney & Wieditz, 2007). The London Plan policy, issued by the United Kingdom government, was identified by Mees and Driessen (2011) as one of the most important policies that supports the delivery of mitigation and adaptation strategies. The integration of the Urban Greening Program (including green roof policy) into this plan is an essential key of adaptation (Mees & Driessen, 2011).

Local-level actions for climate change adaptations

Local efforts include integrating climate change impacts into local development planning. This approach provides an opportunity to implement context-specific adaptation and mitigation options for local or regional scenarios. Communities can have diverse levels of capacity and vulnerability to climate change; therefore community level planning can focus on the needs and abilities of their community. The best method to address climate change at the local level is to emphasize the linkages between climate change adaptation and mitigation in a sustainable development context, using sustainable development as a priority to promote adaptation measures (Bizikova et al., 2007).

BEST PRACTICE

Throughout stakeholder engagement exercises, EA practitioners should encourage and work with local organizations pursuing adaptation and sustainability strategies.

The importance of regional or local-level actions to adapt to and mitigate climate change crises is already recognized by policy makers, organizations and communities (Bizikova et al., 2007). However, local politicians are resisting investments in adaptation measures in favour of mitigation measures that stimulate the development of "no-regrets" measures, such as promoting energy efficient building to reduce consumption cost and GHG emissions (Hallegatte, 2009; Mees et al., 2013). No-regret measures are defined as, "activities that yield benefits even in the

absence of climate change" (European Climate Adaptation Platform, 2015). Government officials and stakeholders are more likely to accept and promote no-regret measures over other climate change considerations. As a result, the use of no-regret measures that lead to climate change adaptation or mitigation can provide a pathway to implement adaptation strategies (Burch, 201). These 'no-regret climate change measures' are a means to promote climate change considerations in adaptation strategies.

BEST PRACTICE

No-regret climate change measures should be identified during discussions regarding adaptive management, and should become a focus of the adaptive management plan.

Key Findings and Best Practices

The efforts to address climate change adaptation and mitigation at a local level are fruitful and should continue and EAs with common interests should engage with the existing efforts. The best practice associated with this key finding is that throughout stakeholder engagement exercises, EA practitioners should encourage and work with local organizations pursuing adaptation and sustainability strategies.

The implementation of no-regrets measures was identified as a means to gain support of local government officials and other stakeholders. Therefore a best practice is that, no-regret climate change measures should be identified during discussions regarding adaptive management, and should become a focus of the adaptive management plan.

3.4 Existing Guidelines for the Integration of Climate Change Considerations into EAs

In total, the literature review identified 11 publications that directly addressed and provided novel information regarding the integration of climate change adaptation and mitigation into EAs (Bell, Collin & Young, 2003; FPTCCCEA, 2003; Draaijers & van der Velden, 2009; Institute of Environmental Management & Assessment, 2009a; IEMA, 2009b; The Organization for Economic Co-operation and Development, 2009; Agrawala, Kramer, Prudent-Richard & Sainsbury, 2010; NSE, 2011; Sok et al., 2011; Byer et al., 2012; Ohsawa & Duinker, 2014). Of these publications, five were directly related to the Canadian context, this indicates a strong Canadian presence in the growing literature of climate change integration into EAs. However, none were specifically focused on the Ontario EA process, therefore justifying the need for a framework specifically tailored to the Ontario context.

KEY POINT

Existing Guidelines
Climate Change considerations can be integrated into EAs through the use of principles and existing EA legislative requirements.

A common characteristic of the existing guidelines for the integration of climate change considerations into EAs is that they prescribe the integration of climate change considerations through the identification of principles and through guidelines describing integration into the phases of the EA process.

Integration Prescribed through Principles

The utility of principles is that they are flexible and can be framed to work within any EA process. The most commonly referenced principles for the integration of climate change considerations into EA are paraphrased and presented as follows. The principles are not ordered according to any deemed importance or chronological application.

Principle 1: The EA should address, the potential impact of climate change on the project; and the potential impact of the project on climate change (greenhouse gas emissions)[1] (FPTCCCEA, 2003; OECD, 2009; Agrawala et al., 2010; NSE, 2011; Byer et al., 2012; Ohsawa & Duinker, 2014).

Principle 2: Adaptation and mitigation measures should be identified and integrated directly into the EA process[2]. Proponents should avoid creating a separate document dedicated to climate change (IEMA, 2009b; NSE, 2011; Sok et al., 2011).

Principle 3: The consideration of climate change adaptation and mitigation should be addressed regardless of existing regulatory guidelines (Sok et al., 2011), and should consider all current climate change policies that are relevant within the project's jurisdiction (Bell et al., 2003; FPTCCCEA, 2003).

Principle 4: Climate change adaptation and mitigation measures should be considered based on a life-cycle assessment of the project (FPTCCCEA, 2003; IEMA, 2009b; Byer et al., 2012).

Principle 5: Decisions regarding the application of climate change adaptation and mitigation practices should be based on the precautionary principle of "do no harm" (Bell et al., 2003; Byer et al., 2012).

[1] Sok *et al. (2011) presented a different opinion regarding the categorization of focus areas. Guidelines should focus on, 1) identifying specific climate change information to be incorporated and reported, 2) methods of communicating climate change and 3) identifying adaptation and mitigation measures on a project-specific basis.*

[2] Draaijers & van der Velden *(2009) identified that the considerations of climate change should be produced in a separate document, whereas all other authors favoured the direct integration of climate change adaptation and mitigation into environmental assessment.*

Principle 6: At least three climate change projections should be produced using the best scientific information, and should be based on an assessment of the baseline environment and scenario analysis beyond simple historical climate data that includes scientific, local and traditional knowledge (FPTCCCEA, 2003; Agrawala et al., 2010; Byer et al., 2012).

Principle 7: Risk assessment approaches should be utilized for effective decision making, however, a need for accurate climate change predictions should not be over-emphasized (Bell et al., 2003). Risk assessment approaches and climate change predictions should be supplemented with explanation and justification for decisions, including reference to the degree of confidence held and uncertainty held (Byer et al., 2012).

Principle 8: Stakeholder involvement should be considered to ensure the best available climate change knowledge is utilized and understood by all invested parties (Sok et al., 2011; Byer et al., 2012)

Principle 9: If a project is deemed vulnerable to climate change an adaptation or 'adaptive management' plan should be produced that is focused on risk reduction, the application of no regrets measures, the long-term nature of climate change, and the uncertain nature of climate-change (FPTCCCEA, 2003; NSE, 2011; Byer et al., 2012).

Principle 10: Clearly defined qualitative and quantitative data should be provided regarding GHG emissions, over the life-time of a project, and should be compared against regional government or industry reduction targets, not national rates of emissions (Byer et al., 2012; Ohsawa & Duinker, 2014). Significance of GHG emissions should be determined using a reasoned argumentation approach that integrates scientific and local knowledge with qualitative and quantitative data (Ohsawa & Duinker, 2014).

Guidelines for Integration within Phases of EA

Principle 2 states that integration should be conducted within the EA process itself. Most of the existing guidelines present the integration of climate change adaptation and mitigation into EA as a breakdown of the steps of an EA and the identification of opportunities for integration. Figure 2 outlines a paraphrased and amalgamated example of the integration points and steps commonly identified. Phases 1 through 7 are a combination of phases identified in the literature; each document provided a slightly different perspective on integration into the phases of an EA. The identified phases are not a reflection of the Ontario EA process. The phases are general headings to represent the combination of various EA process evaluated by the existing guidelines. For ease of readability and understanding of Figure 2, a brief explanation of the identified EA phases is explained in Appendix A.

The most commonly addressed areas for integration were during scoping, assessment of impacts and Valued Ecosystem Components (VEC) and mitigation measures. Suggestions for integration

may be repeated across different entry points if authors provide varying opinions on when the suggestion should be addressed. Considerations that can accomplish both mitigation and adaptation are presented as points within each of the phases' heading "Considerations for Integration". Unlike the other existing guidelines, FPTCCCEA (2003) identified specific factors for mitigation and adaptation. Therefore when appropriate, the considerations are identified as specifically tailored for mitigation or adaptation. All other considerations are identified to be able to accomplish both.

Figure 2. Identified Considerations for Integration of Climate Change Adaptation and Mitigation into the Phases of EA.

<table>
<tr><th colspan="2">EA Phase 1 Project Identification and Description</th></tr>
<tr><td colspan="2">Considerations for Integration:</td></tr>
<tr><td colspan="2">-define project in context of climate change, identify alternatives (Agrawala et al., 2010). For example, the project's energy sources can be defined within the operational processes and activities; size and layout of project can be described in terms of loss of carbon sink due to any required forest removal; estimated and anticipated GHG emissions can be described by the processes contributing to the emissions (NSE, 2011)
-identify the climate risks and effects on project vulnerability based on location (OECD, 2009; NSE, 2011)
-identify regulations relevant to climate change, such as GHG emission regulations (Agrawala et al., 2010)
-if climate change considerations were made prior to project design, then the considerations should be described in detail (NSE, 2011)
-incorporate the cost of adaptation measures into the design process (IEMA, 2009a)</td></tr>
<tr><th colspan="2">EA Phase 2 Scoping</th></tr>
<tr><td colspan="2">Considerations for Integration:</td></tr>
<tr><td colspan="2">-identify climate variables to be assessed (Agrawala et al., 2010)
-identify regulations relevant to climate change, such as GHG emission regulations (Sok et al., 2011)
-include issues raised by stakeholders, regulators and public regarding climate change (NSE, 2011)
-justify design criteria based on predicted climate changes and code (ie. building code)-related issues that may be affected throughout the lifetime of the project, amend design criteria appropriately (Bell et al., 2003)
-identify alternatives to mitigate, or adapt to, climate change (Byer et al., 2012)
-identify how spatial and temporal boundaries and climate change could impact VEC and areas of environmental concern (Bell et al., 2003; NSE, 2011)
-determine if effects of climate change could impact ecological boundaries past the lifetime of the project (Bell et al., 2003)
-identify administrative boundaries in regard to climate change and potential for changes in management (Bell et al., 2003)</td></tr>
<tr><th>Mitigation</th><th>Adaptation</th></tr>
<tr><td>-identify potential GHG considerations (FPTCCEA, 2003)</td><td>-identify potential impacts of climate change on the project (FPTCCCEA, 2003)</td></tr>
</table>

<table>
<tr><th colspan="2">EA Phase 3 Data Information and Collection</th></tr>
<tr><td colspan="2">Considerations for Integration:</td></tr>
<tr><td colspan="2">-determine baseline environment characteristics , including climate conditions (Agrawala et al., 2010)
-identify the project's sensitivity to regional climatic parameters (magnitude, distribution, and rate of change) through climate risk assessments (OECD, 2009; Agrawala et al., 2010)
-utilize independent climate change experts to peer review content of EIS (Environmental Impact Statement) (Sok et al., 2011)</td></tr>
<tr><th>Mitigation</th><th>Adaptation</th></tr>
<tr><td>-if required, determine specific GHG considerations for the industry and project (FPTCCCEA, 2003)
-compare with provincial GHG emission targets and request opinion of provincial government (Ohsawa & Duinker, 2014)</td><td>-identify regional climate projections and project sensitivity to these climate projections (FPTCCCEA, 2003)</td></tr>
<tr><th colspan="2">EA Phase 4 Impact Assessment and Identification of Valued Ecosystem Components (VEC)</th></tr>
<tr><td colspan="2">Considerations for Integration:</td></tr>
<tr><td colspan="2">-the risk to public and environment will determine whether impact management is required, if risk is determined, proceed to step 6, if not document and justify results (Agrawala et al., 2010)
-include issues raised by stakeholders, regulators and public regarding climate change and its impacts on VECs (NSE, 2011)
-identify history of extreme events in region and projected climate change (NSE, 2011)
-identify if VECs should be evaluated based on potential climate change projections for the lifetime of the project, and once identified should be scoped again forming an iterative loop (Bell et al., 2003)
-VECs are not likely to change because of climate change considerations, however consultation with specialists can determine if changes should be made (NSE, 2011; Bell et al., 2003)
-impact predictions should consider the sensitivities of VECs to climate change and significance of impacts should be determined based on three criteria: scenarios, vulnerability and resilience (IEMA, 2009a; NSE, 2011)
-cumulative impacts should be identified based on climate change associated primary and secondary effects (Bell et al., 2003)
-identify uncertainty of climate projections and incorporate uncertainty directly into the definition of the impacts (Bell et al., 2003)</td></tr>
<tr><th>Mitigation</th><th>Adaptation</th></tr>
<tr><td>-determine if GHG considerations are direct or indirect emissions, their magnitude and any effects on carbon sinks (FPTCCCEA, 2003; Byer et al., 2012)
-determine action regarding GHG emissions based on multiple criteria including comparison to regional/provincial targets and social costs of offsetting emissions (Ohsawa & Duinker, 2014)</td><td>-assess two considerations: 1) impact on project, 2) risk to public and environment including an estimation of probability and severity of climate change (FPTCCCEA, 2003; NSE, 2011)</td></tr>
</table>

EA Phase 5 Effects of the Environment on the Project (NSE, 2011)	
Considerations for Integration:	
-most appropriate section to discuss impacts of climate change on the project itself (NSE, 2011) -effects of the environment on the project should use same criteria as within EA process - including magnitude, geographic extent, duration and frequency, irreversibility, ecological context and likelihood (Bell et al., 2003) -identify project as having a low/no risk, medium risk, or high risk of the environment negatively impacting its functioning in the future due to climate change (NSE, 2011) -take action if medium or high risk is determined, by producing adaptation management plan, provide justification if low/no risk is determined (NSE, 2011)	
EA Phase 6 Mitigation Measures	
Considerations for Integration:	
-identify mitigation measures to reduce project's vulnerability to climate change, increase resilience and ability to absorb climate change variability (IEMA, 2009a; Agrawala et al., 2010) -determine risks and responsibilities for private and public sector regarding climate change mitigation measures (Agrawala et al., 2010) -focus on ongoing risk assessment, information gathering and continued attempts to reduce uncertainty (FPTCCEA, 2003; Agrawala et al., 2010)	
Mitigation	**Adaptation**
-if determined necessary, produce GHG management plan based on jurisdictional requirements and specific considerations of the project (FPTCCCEA, 2003; NSE, 2011) -management of GHG emissions should follow the hierarchy of, first avoid, reduce, substitute, then compensate (IEMA, 2009b)	-prioritize and select adaptation options, impact management plan (FPTCCCEA, 2003; OECD, 2009; NSE, 2011)
EA Phase 7 Monitoring and Follow-up Plans	
Considerations for Integration:	
-should focus on entire lifecycle of project (construction, operation and maintenance) (Agrawala et al., 2010) -monitor effectiveness of adaptation and mitigation measures, implement action if necessary (OECD, 2009; Agrawala et al., 2010) -continue to address growing understanding of climate change knowledge and policy (Agrawala et al., 2010) -create "Climate Change Adaptation Program" (Agrawala et al., 2010) -create an adaptive management plan (FPTCCCEA, 2003; NSE, 2011)	

Figure 2 is an amalgamation of the existing guidelines' key points for the integration of climate change considerations into the steps of EA. In general, the guidelines provided both principles and considerations for integration into the steps of EA. The considerations for integration are therefore highly reflective of each of the guidelines' identified principles. For example, *Principle 6,*

> At least three climate change projections should be produced using the best scientific information, and should be based on an assessment of the baseline environment and scenario analysis beyond simple historical climate data that includes scientific, local and traditional knowledge

is prescribed by Agrawala et al. (2010). Agrawala (2010) additionally identifies that during EA Step 3, Data Information and Collection, the EA practitioner should be to determine baseline environment characteristics, including climate conditions. This is a reflection of the need for an assessment of the baseline environment.

Key Findings and Best Practices

Climate Change considerations can be integrated into EAs through the use of principles and existing EA phases. The principles are drivers of the considerations identified for the integration into the phases of EA. The principles, therefore, can be utilized as best practices to inform the integration of considerations into EA. The principles are modified to better reflect the requirements of a best practice, such that they can inform how and when a climate change consideration can be integrated into the EA process.

BEST PRACTICE

When determining the impacts of the project, the EA should address, the potential impact of climate change on the project; and the potential impact of the project on climate change (greenhouse gas emissions).

Climate change considerations and adaptation and mitigation measures should be identified and integrated directly into all phases of the EA process. Proponents should avoid creating a separate document dedicated to climate change.

The consideration of climate change adaptation and mitigation should be addressed as an aspect of the project description, regardless of existing regulatory guidelines, and should consider all current climate change policies that are relevant within the project's jurisdiction.

Climate change adaptation and mitigation measures should be considered based on a life-cycle assessment of the project when addressing impacts of the project on climate change, and the impacts of the environment of the project.

Decisions regarding the application of climate change adaptation and mitigation practices, during impact mitigation efforts, should be based on the precautionary principle of "do no harm".

When identifying the impacts of the project on climate change, and the impacts of the environment of the project, at least three climate change projections should be produced using the best scientific information. These projections should be based on an assessment of the baseline environment and scenario analysis beyond simple historical climate data that includes scientific, local and traditional knowledge.

Risk assessment approaches should be utilized for effective decision making when determining the significance of identified impacts. Risk assessment approaches and climate change predictions should be supplemented with explanation and justification for decisions, including reference to the degree of confidence held and uncertainty held.

Stakeholder involvement should be considered, throughout all phases of the EA process, to ensure the best available climate change knowledge is utilized and understood by all invested parties.

If a project is deemed vulnerable to climate change an adaptation or 'adaptive management' plan should be produced that is focused on risk reduction, the application of no regrets measures, the long-term nature of climate change, and the uncertain nature of climate-change.

When determining the impacts of the project on climate change, clearly defined qualitative and quantitative data should be provided regarding GHG emissions, over the life-time of a project. The emissions should be compared against regional government or industry reduction targets, not national rates of emissions. Significance of GHG emissions should be determined using a reasoned

3.5 Challenges and Barriers to the Integration of Climate Change Adaptation and Mitigation into EAs

The best practices for the integration of climate change adaptation and mitigation identified provide a basic framework for integration into EAs. However, there are several challenges that must be addressed to ensure successful integration. The literature review identified two publications that focused on identifying the challenges and barriers to implementation (Slotterback, 2011; Denga, 2014), additionally several publications made reference to major challenges. Presented below is a list of commonly identified challenges.

KEY POINT

Challenges
Major Challenges inhibiting integration of climate change into EA include: uncertainty, stakeholder engagement, project and strategic level scoping.

Challenge 1: Uncertainty is ultimately the largest inhibiting factor to the successful implementation of mitigation and adaptation measures. There is uncertainty regarding scientific projections of climate change, the impacts of climate change on a project and the climate change projections at the project scale (Agrawala et al., 2010; Slotterback, 2011; Denga, 2014). Additionally, climate change uncertainty is often poorly understood and variably interpreted by practitioners and stakeholders (Byer & Colombo, 2010). Uncertainty is a key challenge therefore, Theme 6 is dedicated to addressing potential solutions to minimize and work with uncertainty.

Challenge 2: Determining the significance of a project's impact on climate change is extremely difficult due to the project's scale and comparisons made regarding the relative importance to global impacts (Slotterback, 2011). Several authors have addressed this issue by suggesting comparisons be made across regional impacts, or industry reduction targets (e.g. Ohsawa & Duinker, 2014). In addition to the frequency that comparisons are made at inconsistent scales, the cumulative and temporal scale of climate change does not adequately align with the temporal scale of EAs, therefore further confounding the problem of significance determination (Slotterback, 2011).

Challenge 3: When climate change is considered a cumulative impact by EA practitioners, the challenges associated with cumulative impacts are also relevant. These challenges include, insufficient methods and understanding of cumulative impact assessments, uncertainty regarding cumulative impacts and inconsistent guidance (Slotterback, 2011). This issue has been addressed by Bell et al. (2003) and refers practitioners to the use of a single cumulative impact assessment method. Guidance on cumulative impact assessments can be found in the *Cumulative Effects Assessment Practitioners' Guide* developed by the Canadian Environmental Assessment Agency (Hegmann et al., 1999).

Challenge 4: Climate change is often not the priority for EA practitioners. It is perceived to be a distinct issue at the global scale that is not relevant for the project scale (Denga, 2014). Practitioners are concerned with upholding legislative requirements for existing impacts at the forefront of their mitigation strategies (Black, Bruce, & Egner, 2014; Denga, 2014). The timeline required to change regulations is far too long, as the considerations of climate change need to be addressed within all current EAs (Byer & Colombo, 2010). Guidance documents will provide the quickest approach to applying climate change adaptation and mitigation considerations into EAs.

Challenge 5: Measurement and projections of climate change are not easy to conduct and require expert knowledge and accurate data. Collaborations between practitioners, climate change scientists and stakeholders are difficult to manage and difficult to gain a consensus regarding decision making (Rodgers, 2013). Additionally, data regarding historical climate conditions is often unavailable, inhibiting the production of reliable forecasting climate projections (Rodgers, 2013). Climate change modeling therefore must be continually re-evaluated throughout the lifetime of the project to ensure the best available data is used as technologies become more sophisticated.

Key Findings and Best Practices

These five identified challenges fall within three major challenges areas: uncertainty, stakeholder engagement, and project and strategic level scoping. These major challenges are explored in further detail in the subsequent sections, including the identification of best practices specific to the major challenges.

Best practices have been identified within previous themes that will provide the necessary actions to overcome these challenges. Challenge 2 identifies a flaw with determining a project's impact based on a comparison of global impacts. An identified best practice states that GHG emissions should be compared against regional government or industry reduction targets.

Challenge 4 identifies a disconnect between regulatory processes and the need for climate change considerations, resulting in stalled progress regarding successful integration. Two identified best practices can provide a means to overcome this challenge,

> Adaptation and mitigation measures should be identified and integrated directly into all phases of the EA process. Proponents should avoid creating a separate document dedicated to climate change.
>
> The consideration of climate change adaptation and mitigation should be addressed as an aspect of the project description, regardless of existing regulatory guidelines, and should consider all current climate change policies that are relevant within the project's jurisdiction.

Climate change considerations should be integrated directly into the EA process, through the use of guidance documents, regardless of regulatory requirements. This will provide a means to

bridge the disconnect and ensure progress is made toward integration of climate change considerations into EA.

3.6 The Uncertainty of Climate Change and its Impacts on the Successful Integration of Climate Change Considerations into EAs

Uncertainty is a primary theme of this literature review due to its identification as a major challenge for the successful integration of climate change adaptation and mitigation into EAs and other policy initiatives. A growing literature was identified regarding how to overcome this challenge and the literature review identified several documents that were focused solely on tackling the problem of uncertainty (Byer & Yeomans, 2007; Byer, Lalani, & Yeomans, 2009; Byer et al., 2011; Byer et al., 2012; and Colombo & Byer, 2012). Methods to address uncertainty include early identification of areas and levels of uncertainty, and the integration of adaptation and mitigation measures into planning and project design. There is wide scientific consensus on the existence of climate change; there is however substantial uncertainty surrounding the timing and degree of the changes associated with the changing climate (Byer et al., 2012). Additionally, there are significant uncertainties about the effects of climate change regionally. Byer et al. (2011) and Colombo and Byer (2012) explain that in the past, project designs could be based on historic climate conditions with relatively high confidence as the climate variability was stable. Climate change however increases the variability of climate parameters making historic data no longer adequate for predicting future climate conditions.

BEST PRACTICE

Address uncertainty early in the process, continually re-evaluate the level of confidence in predicted climate change impacts.

There are two sources of uncertainty during project planning. The first are uncertainties about the future conditions of the climate, the second are uncertainties from modeling future climate at the regional project level from historical data. Typically these uncertainties are addressed by planning for a short project lifespan and assuming that the climate will remain relatively stable during the short time period (Byer et al., 2011). These uncertainties can include: the average temperature increase resulting from a specific increase of GHGs from the project, the effects of projected regional climate change on variables such as temperatures, precipitation and wind, and to systems including terrestrial ecosystems, and water levels that may impact the project, and the effects of the changing climatic variables on socioeconomic systems that may impact the success of the project (Byer and Yeomans, 2007).

While uncertainty may be reduced with advancement in climate modeling, improving the confidence in future climate predictions, some uncertainty will always exist as the extent of climate change within any one region depends on decisions made and emissions released at a global level (TRCA, 2009; Ohsawa & Duinker, 2014). Additionally, the cumulative effects of climate change impacts can introduce high uncertainty for the prediction of climate change

impacts at the regional level (Byer et al., 2009). In spite of the challenges associated with predicting climate change, failure to consider climate change uncertainties in project planning may add high costs to the project, both high socio-economic and/or environmental costs (Byer & Yeomans, 2007).

BEST PRACTICE

The extent of adaptation and mitigation measures proposed for any project should depend of the extent of uncertainties regarding climate change impacts and future impact to climate change determined during the EA of the project.

Byer et al. (2009) identifies a number of ways to address uncertainties at the project level; these considerations however must be made as early in the planning and assessment process as possible. Adaptation and mitigation considerations are ways in which to address climate change uncertainty in project planning. The extent of adaptation and mitigation measures proposed for any project should depend on the extent of uncertainties regarding climate change impacts and future impact to climate change determined during the EA of the project (Byer et al., 2009). The literature does not provide clear guidance on the relationship between the extent of uncertainty and the corresponding extent of adaptation and mitigation measures required.

There are various methods to assess the uncertainties of climate change. Scenario analysis, sensitivity analysis and probabilistic analysis are the most commonly used (Byer & Yeomans, 2007; Byer et al., 2009; Colombo & Byer, 2012). Scenario analyses are the most common of the three and are an examination of the potential climate change impacts based on the selected climate scenarios and have been identified as a principle (Principle 6) for best practice regarding integrating climate change into EAs. Generally, the number of scenarios examined is reduced to scenarios that represent possible ranges within the project area. It is often recommended to apply multiple scenarios that capture a range of potential future climates including scenarios that represent extreme ranges of climate variables as well as intermediate moderate scenarios in which climate variables do not change drastically from historical averages (Colombo & Byer, 2012). Climate variables chosen within the scenarios are dependent on the type of project and the impacts of concern.

Sensitivity analyses identify the areas of vulnerability in a project to determine which climate changes may impact these vulnerabilities. Sensitivity analyses look at "what if" questions such as, if parameter x changed by y amount, what would be the resulting impact? Similarly, what change in variable x would cause a level y of impact? The sensitivity analysis determines thresholds that if crossed can lead to significant impacts. The benefit of a sensitivity analysis is that it can be used to identify the climatic variables with the most significant impacts, and can give them a range of probable values to assess the potential significance to the project, thereby reducing some associated uncertainty. A sensitivity analysis can help guide and scope an EA to focus study on the variables the project is most vulnerable to. Scenario and sensitivity analyses

provide threshold information on changes in variables, but do not examine the probability of the changes within the variables occurring. Assessment of uncertainty should examine both the range of possible variable outcomes and the thresholds at which they may express themselves (Byer & Yeomans, 2007; Byer et al., 2009; Colombo & Byer, 2012).

Probabilistic or simulation methods can address the likelihood of the uncertainties and vulnerabilities examined in the scenario and sensitivity analyses. Probabilistic analysis involves four basic steps, 1) the identification of variables that may cause uncertain risk, 2) determination of the probability of each variable causing risk to the project, 3) simulation of the project performance given the possibilities for risk from the variability, and 4) a summary of the results of the analysis (Byer & Yeomans, 2007; Byer et al., 2009; Colombo & Byer, 2012). Scenario, sensitivity, and probabilistic analyses generally deal with impacts that can be measured quantitatively, there are however many impacts that can only be assessed in qualitative terms. These can be predicted in terms of trend of increase or decrease and by the significance of the change (low, moderate, or high) (Byer & Yeomans, 2007).

Deciding upon a method to assess uncertainty and vulnerability is dependent upon the type of project (Colombo & Byer, 2012). Depending on the project, a combination may prove to be more useful than one method alone. Methods that use probabilities of different variables are advantageous as they provide a measure of the expected confidence of the future climate information and can be combined with desired project outcomes (costs and benefits) to weigh alternatives. Probability analyses can also be updated with new information making it a potential adaptive approach. Methods without probabilities of variables posing a risk to the project are more difficult to quantify and compare, and can be compared through designated decision rules and decision tree methods (Byer et al., 2011).

Once the areas of uncertainty and vulnerability within a project are better understood, adaptation and mitigation measures can be examined and decided upon. Byer et al. (2011) provides a number of adaptation measures for addressing uncertainty. Adaptation measures specific to addressing uncertainty can include: bolstering or reinforcing the existing design, variability management, reconceptualization of the project, and adaptive management (Byer et al., 2011; Colombo & Byer, 2012). Due to the challenges associated with predicting climate change impacts and project vulnerabilities, variations of adaptive management are the strategies most often implemented. The choice of methods to determine and address uncertainties is often based on the type of project, existing requirements, and the stakeholder's attitudes towards risks and uncertainties (Byer et al., 2011). Levels of uncertainty should be re-evaluated throughout project planning and implementation

KEY POINT

Climate Change Uncertainty
If proponents follow guidelines regarding best practices for integrating climate change considerations, then uncertainty can be addressed in tandem.

(Byer et al., 2011). Clearer guidelines within formal EA planning processes can help reduce the uncertainties associated with assessing climate change uncertainty and project vulnerability.

Key Findings and Best Practices

In spite of the challenges associated with predicting climate change, the literature supports the continued attempts to consider climate change uncertainties. The literature regarding climate change uncertainty and EA provides support and refinement for a number of identified best practices, as well as providing additional best practices for the integration of climate change considerations into EA.

The best practice associated with Principle 6,

> When identifying the impacts of the project on climate change, and the impacts of the environment of the project, at least three climate change projections should be produced using the best scientific information. These projections should be based on an assessment of the baseline environment and scenario analysis beyond simple historical climate data that includes scientific, local and traditional knowledge.

is supported further as a result of considerations regarding the uncertainty of climate change. Climate change increases the variability of climatic parameters, thereby reinforcing the need for additional resources beyond the use historical climate data to make climate projections. Scenario analysis is identified as a method to overcome uncertainty, and additionally is a prescribed best practice associated with Principle 6. The previously identified best practice can be further refined to include the application of multiple scenarios, at least three, that capture a range of potential future climates. This should include scenarios that represent extreme ranges of climate variables, moderate ranges and variables similar to historical averages.

Risk assessments are deemed to be a best practice by the existing guidelines,

> Risk assessment approaches should be utilized for effective decision making when determining the significance of identified impacts. Risk assessment approaches and climate change predictions should be supplemented with explanation and justification for decisions, including reference to the degree of confidence held and uncertainty held.

Discussed in further detail during this theme, the risk assessment should include methods such as sensitivity analysis. The usefulness of sensitivity analysis is that is enables the practitioner to examine both the range of possible variable outcomes and the thresholds at which they may express themselves.

The literature on uncertainty reinforces the importance of the previously identified best practice,

> Adaptation and mitigation measures should be identified and integrated directly into all phases of the EA process. Proponents should avoid creating a separate document dedicated to climate change.

The creation of guidelines for addressing uncertainty within the formal EA process was identified as a means to enable practitioners to effectively assess project vulnerability. If proponents follow guidelines regarding best practices for integrating climate change considerations, then uncertainty can be addressed in tandem. Adaptation and mitigation are applicable best practices because they are identified as methods to address climate change uncertainty during project planning. The literature builds off of this concept to produce an additional best practice. Such that, the extent of adaptation and mitigation measures proposed for any project should depend of the extent of uncertainties regarding climate change impacts and future impact to climate change determined during the EA of the project.

An additional best practice identified within this theme to address uncertainty, and therefore successfully integrate climate change considerations into EAs, is to address uncertainty early within the process and continually re-evaluate the vulnerability of the project throughout its lifecycle.

3.7 Importance of Stakeholder Engagement for the Integration of Climate Change into EAs

Stakeholder engagement has been identified as a factor that can either be a challenge or a benefit to addressing uncertainty. As a regulatory requirement of EA processes, stakeholder engagement is a necessary consideration for the integration of climate change adaptation and mitigation into EAs. Stakeholder engagement can be a challenge as climate change uncertainty is often poorly understood and variably interpreted by practitioners and stakeholders. Byer et al. (2012) states that it is important to ensure all stakeholders who are affected by or wish to participate in an EA understand climate change and how it is being addressed to ensure positive stakeholder engagement.

KEY POINT

Stakeholder Engagement
Stakeholder engagement can be considered to be either a benefit or a challenge to successful integration of adaptation and mitigation into EAs.

Sok et al. (2011) provides an interesting insight into why public and stakeholder engagement is necessary for EAs considering climate change. A survey of 164 members of the International Association for Impact Assessment identified two distinct justifications for stakeholder engagement, 1) local knowledge will provide useful input for climate change mitigation and

adaptation efforts and 2) there is a lack of stakeholder knowledge regarding climate change and how it can affect and be affected by a project (Sok et al., 2011).

BEST PRACTICE

Stakeholder knowledge of climate change should be considered, throughout all phases of the EA process. The best available climate change knowledge should utilized when determining climate change scenarios, the impacts of climate change on the project and impacts of the project on the climate.

In relation to the first justification, Toronto Environment Office (2008) identifies public and stakeholder engagement to be a necessary step in the development of an adaptation strategy. Feltmate and Thistlethwaite (2012) identify that stakeholder engagement builds local capacity and recognition of how adaptation relates to their everyday jobs. Bruce, Egener and Noble (2006), hold stakeholder engagement as a principle of risk management, and PEDC (2011) state that stakeholder engagement is fundamental to the notion of sustainability.

In order to address the second justification for stakeholder engagement, Yeomans (2004) and Byer et al. (2009) produced frameworks for communicating the uncertainty of climate change. These frameworks value the necessity to communicate in a variety of medium with the ultimate goal of, 1) effectively communicating technical results regarding the range of climate change impact scenarios and 2) effectively communicating the scientific degree of belief in and acceptance of the climate change projections utilized (Byer et al., 2009).

BEST PRACTICE

Prior to the initiation of the EA create a process focused on understanding climate change and uncertainty that will promote opportunities for positive engagement.

Key Findings and Best Practices

Stakeholder engagement can be considered to be either a benefit or a challenge to successful integration of adaptation and mitigation into EAs. Both aspects of stakeholder engagement can be used to inform best practices. To enhance the benefits of stakeholder engagement, a best practice is to utilize stakeholder knowledge of climate change to ensure the best available climate change knowledge is utilized when determining climate change scenarios, the impacts of climate change on the project and impacts of the project on the climate. To overcome the challenge of stakeholder engagement a best practice is, prior to the initiation of the EA create a process focused on understanding climate change and uncertainty that will promote opportunities for positive stakeholder engagement.

3.8 Integration of Climate Change Considerations at Project Level and Strategic Level EA

EA frameworks can be used to take into account climate change in exercises of future planning. EA frameworks can be designed to minimize the adverse effects of climate change by reducing an activity's GHG emissions, and can promote the integration of adaptation measures to protect activities from the effects of climate change (Sok et al., 2011). Climate change adaptation and mitigation, however, are currently not well integrated into most EA practise, and there are some limitations regarding the effectiveness of working within existing EA frameworks. The shortcomings of most EA practices are related to the narrow scope of the project level impact assessment process, as identified in Challenge 2. In most cases, project EAs are carried out at the later stage of project planning, wherein most parameters of the project scope have been already established, providing a limited window within which to integrate climate change adaptation and mitigation measures into the examination of the proposed project (OECD, 2009). Furthermore, most EA processes are based upon the identification of project impacts on the environment and do not require examination of impacts on the project from environmental change. Activities associated with a project that are not considered to have environmental impacts are therefore scoped out of the EA process though they may still be vulnerable to future impacts from climate change (OECD, 2009). Additionally, project level EAs generally consider impacts only within the spatial scope of the project site or within a narrow scope just outside the project site. A project's impact to the climate, however, can reach areas outside this narrow project scope and the impacts from climate change on the project can be a result of a multitude of sources from around the globe. The impacts to climate and the impacts of climate change are a global phenomenon that cannot be constrained to a narrow geographic and temporal scope, as most project level EAs are (Wend, Bond, Bobylev & Stratmann, 2012).

The temporal scope of project level EA, as identified in Challenge 2, poses a barrier to integrating climate change considerations. Project level EAs generally regard long term impacts as those lasting only as long as the lifetime of the project, a time scale not conducive to considering the inherently long time scale at which climate change exists at (Wend et al., 2012).

Considering some of the shortcomings of the scope of project level EAs, Strategic Environmental Assessments (SEAs) may provide a useful tool for integrating climate change adaptation and mitigation into project development. SEAs are a response to project EAs that are often reactionary, narrowly scoped, and poorly integrated into broader political processes. Integrating climate change adaptation and mitigation into SEAs may allow for consideration of the impacts from climate change on development earlier in the planning process rather than later at the project stage where the opportunity for assessing the impacts of climate change is narrowed

KEY POINT

Project and Strategic Level EA
Climate change should be addressed at both the project and strategic level to ensure complete integration into planning.

(OECD, 2009). SEAs promote thinking of future planning that spans over a longer term, and aids in assessing the cumulative impacts of multiple projects (Wend et al., 2012). As many countries and organizations are adopting SEA frameworks to assess the impacts of long term policies, plans, and programs, SEA may be a suitable tool for integration of climate change adaptation and mitigation strategies (OECD, 2009). As project level EAs are a legislative framework set within broader policy contexts, having formal processes for addressing considerations of climate change impacts outside of project EA processes may remove some of the need for climate change consideration into the project level EA, streamlining the process. Furthermore, SEA may be beneficial as climate change mitigation and adaptation strategies can take on a wide range of forms such as through policy, regulation, monitoring, and enforcement, most of which exists upstream and outside of the formal project level EA scope (Sok et al., 2011).

SEA provides a mechanism to introduce climate change earlier in the planning process; therefore overcoming some of the shortcomings of project level EA. Project level EA, however, can address specific issues of climate change impacts to a project not addressed within the broad scope of an SEA (Byer et al., 2009). Most jurisdictions have an existing mandatory framework for carrying out project level EA, which is one benefit of using project level EA processes to integrate climate change adaptation and mitigation thought into the assessment of development projects. Many jurisdictions are similarly adopting frameworks for SEAs; however they are not as prominent and, in Canada, have less influence as they are often not legal regulations (OECD, 2009). EA procedures are often legal obligations and are difficult to develop and amend however, integrating climate change into both strategic and project level EA practice can reduce the limitations of each, producing a model where climate change adaptation and mitigation is considered at all levels of planning (Sok et al., 2011). In the interim, guidance documents may provide the quickest approach to integrating climate change within EA practice given the previously identified challenge of time limitations (Challenge 4).

KEY POINT

Project and Strategic Level EA

Guidance documents may provide the quickest approach to integrating climate change considerations into EAs.

Key Findings and Best Practices

Pursuing legislative requirements at the SEA and the Project level EA will create a functional redundancy; this allows each process to compliment the shortcomings of the other. This theme highlights that legislative requirements at the project level EA do not necessarily ensure complete integration of climate change considerations into EA processes.

This theme supports the best practice,

> The consideration of climate change adaptation and mitigation should be addressed as an aspect of the project description, regardless of existing regulatory guidelines, and should consider all current climate change policies that are relevant within the project's jurisdiction.

This is because in the absence of legislative changes at project and strategic levels, guidance documents may provide the quickest approach to integrating climate change within EA practice given the previously identified challenge of time limitations for regulatory changes.

4.0 Conclusion

The goal of the literature review was to identify best practices for the integration of climate change adaptation and mitigation into EAs. Each section provided novel information toward achieving this goal and has contributed to the identification of key points and best practices. A best practice is defined as a statement that informs an action that is deemed to be an effective and accepted method to achieve a desired goal. Best practices for the integration of climate change adaptation and mitigation into EA are actions that inform when and how a specific climate change consideration can be integrated into the existing regulatory process.

Key Points

The key points identified throughout the analysis of all 8 themes do not necessarily inform a specific action, but identify rationales for climate change integration into EAs and provide justification for best practices.

Adaptation and Mitigation: Regulatory frameworks can build capacity to address and adopt adaptation and mitigation measures.

Green Infrastructure: Climate change considerations, such as green infrastructure, should be integrated into the EA process because EAs provide a means to ensure that the resultant benefits to infrastructure are obtained.

Existing Plans and Policies: Efforts to address climate change are being made at local levels; EAs should engage with the existing efforts at this level.

Existing Guidelines: Climate Change considerations can be integrated into EAs through the use of principles and existing EA legislative requirements.

Challenges: Major challenges inhibiting the integration of climate change into EA include: uncertainty, stakeholder engagement, project and strategic level scoping.

Climate Change Uncertainty: If proponents follow guidelines regarding best practices for integrating climate change considerations, then uncertainty can be addressed in tandem.

Stakeholder Engagement: Stakeholder engagement can be considered to be either a benefit or a challenge to successful integration of adaptation and mitigation into EAs.

Project and Strategic Level EA: Climate change should be addressed at both the project and strategic level to ensure complete integration into planning. Guidance documents may provide the quickest approach to integrating climate change considerations into EAs.

Best Practices

Best practices can be utilized to apply climate change considerations within EA and can inform the creation of a guidance document. In theme 7, guidance documents are identified as the fastest means to integrate climate change considerations into the EA process. Best practices were identified through the analysis of themes and therefore are not presented within the text of the literature review in chronological order of their intended application. Presented below is a consolidated list of best practices, identified and modified throughout the literature review, in their intended chronological use throughout the EA process. Best Practices 1-11, can be integrated directly into the EA process. Best Practices 12-14 are focused on stakeholder engagement, which is to be conducted in conjunction with the Best Practices 1-11. Laslty, Best Practice 15 is focused on uncertainty, which should be considered throughout the entire EA process.

Best Practice 1: Climate change considerations and adaptation and mitigation measures should be identified and integrated directly into all phases of the EA process. Proponents should avoid creating a separate document dedicated to climate change.

Best Practice 2: The consideration of climate change adaptation and mitigation should be addressed as an aspect of the project description, regardless of existing regulatory guidelines, and should consider all current climate change policies that are relevant within the project's jurisdiction.

Best Practice 3: When determining the impacts of the project, the EA should address, the potential impact of climate change on the project; and the potential impact of the project on climate change (greenhouse gas emissions).

Best Practice 4: When determining the impacts of the project on climate change, clearly defined qualitative and quantitative data should be provided regarding GHG emissions, over the life-time of a project. The emissions should be compared against regional government or industry reduction targets, not national rates of emissions. Significance of GHG emissions should be determined using a reasoned argumentation approach that integrates scientific and local knowledge with qualitative and quantitative data.

Best Practice 5: When identifying the impacts of the project on climate change, and the impacts of the environment of the project, at least three climate change projections should be produced using the best scientific information. These projections should be based on an assessment of the baseline environment and scenario analysis beyond simple historical climate data that includes scientific, local and traditional knowledge.

Best Practice 6: Risk assessment approaches should be utilized for effective decision making when determining the significance of identified impacts. Risk assessment approaches and climate change predictions should be supplemented with explanation and justification for decisions, including reference to the degree of confidence held and uncertainty held.

Best Practice 7: Climate change adaptation and mitigation measures should be considered based on a life-cycle assessment of the project when addressing impacts of the project on climate change, and the impacts of the environment of the project.

Best Practice 8: EAs should utilize strategies, such as green infrastructure, that accomplish both adaptation and mitigation when attempting to manage the impacts of a project.

Best Practice 9: Decisions regarding the application of climate change adaptation and mitigation practices, during impact mitigation efforts, should be based on the precautionary principle of "do no harm".

Best Practice 10: The extent of adaptation and mitigation measures proposed for any project should depend of the extent of uncertainties regarding climate change impacts and future impact to climate change determined during the EA of the project.

Best Practice 11: If a project is deemed vulnerable to climate change an adaptation or 'adaptive management' plan should be produced that is focused on risk reduction, the application of no regrets measures, the long-term nature of climate change, and the uncertain nature of climate-change.

Best Practice 12: Stakeholder knowledge of climate change should be considered, throughout all phases of the EA process. The best available climate change knowledge should be utilized when determining climate change scenarios, the impacts of climate change on the project and impacts of the project on the climate.

Best Practice 13: Prior to the initiation of the EA, a stakeholder engagement process should be created that is focused on understanding climate change and uncertainty and promoting opportunities for positive engagement.

Best Practice 14: Throughout stakeholder engagement exercises, EA practitioners should encourage and work with local organizations pursuing adaptation and sustainability strategies.

Best Practice 15: Address uncertainty early within the process and continually re-evaluate the vulnerability of the project throughout its lifecycle.

Final Thoughts

Ontario's strategic documents indicate that climate change adaptation and mitigation are priorities; however the integration of climate change considerations into regulatory processes is not yet established. The literature review identified a number of best practices for the integration of adaptation and mitigation into EAs. EA procedures however are difficult to develop and amend. In the interim, guidance documents may provide the quickest approach to integrate climate change within EA practice.

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Appendix A Explanation of EA Phase Requirements and Goals

EA Phase 1 Project Identification and Description
Explanation of Phase:
The project proponent must clearly describe the proposed project. Questions to be answered by the proponent include: What is to be achieved by engaging in the EA process? Why does the proponent need to do this study or pursue the particular undertaking? The responses must be stated in terms of the project's intended effect on society, the problem it will solve or alleviate, or the opportunity the undertaking is to pursue. Project Identification and Description allow for consideration of alternatives to the proposed project EA. Alternatives can include alternatives to the proposed undertaking, and alternatives methods of carrying out the proposed undertaking.
Goal of Phase:
To provide a general understanding of the nature of the project, and its potential impacts on the environment. This phase is the foundation that subsequent phases build off of.
EA Phase 2 Scoping
Explanation of Phase:
In Scoping, the proponent must define the study area in which the proposed project is to be located and must describe the existing environment within the study area. The description of the environment must include all components of the social, cultural, economic, built and natural environment.
Goal of Phase:
Determine a detailed understanding of the scope and impacts of the project on the environment. This includes the temporal and spatial scope.
EA Phase 3 Data Information and Collection
Explanation of Phase:
The proponent must conduct data collection and analysis to determine the baseline environmental characteristics of the project area. Baseline assessment of the existing environment is the tool with which to determine the proposed projects VECs.
Goal of Phase:
Determine the baseline environmental characteristics of the project area. This will be used as a tool to determine significance of potential impacts of the project.

EA Phase 4 Impact Assessment and Identification of Valued Ecosystem Components (VEC)
Explanation of Phase:
Once the baseline assessment is completed and the environmental boundaries and VECs are determined the proponent must evaluate the effects to the VECs from the proposed project alternatives. All potential positive and negative direct and indirect effects from the project must be identified and examined.
Goal of Phase:
Determine the relevant VECs and the significance of the project's impact on these VECs.
EA Phase 5 Effects of the Environment on the Project (NSE, 2011)
Explanation of Phase:
This phase was proposed by NSE (2011). The proponent should determine if changes in climatic conditions, such as increase rain events, will have a significant impact on the project in the future. The potential impacts should be measured based on their predicted magnitude, geographic extent, duration and frequency, irreversibility, ecological context and likelihood.
Goal of Phase:
Determine project's vulnerability to changing climates, and specific climatic variables.
EA Phase 6 Mitigation Measures
Explanation of Phase:
The project proponent must provide a description of the how they will minimize or prevent the risks or negative environmental effects while enhancing the positive environmental effects of the proposed project.
Goal of Phase:
Determine best method for mitigating impacts of the project on the environment.
EA Phase 7 Monitoring and Follow-up Plans
Explanation of Phase:
The mitigation measures identified in Phase 6 should be monitored by the proponent to determine their effectiveness. This will require the use of scientific data, stakeholder knowledge and monitoring programs. Should mitigation efforts fail, a program must be in place to determine best methods to rectify it.
Goal of Phase:
Ensure mitigation efforts are successful, and the impacts to the environment that can be avoided are avoided.

Document 2

Practitioner Guideline for the Integration of Climate Change Considerations into the Ontario Environmental Assessment Process

Prepared for
Ontario Climate Consortium | Toronto Region Conservation Authority (TRCA)

Prepared by

K-NEX Consulting

Connecting you to a sustainable future

April 14, 2015

The following guidance document was authored by K-NEX Consulting. The development of this guidance document was commissioned by the Toronto and Region Conservation Authority (TRCA) as secretariat of the Ontario Climate Consortium (OCC).

Practitioner Guideline Table of Contents

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1.0 Introduction

This guidance document is a broad informational practitioner guideline containing recommended steps and considerations for the integration of climate change adaptation and mitigation into the broad Ontario Environmental Assessment process. The recommended steps are informed by existing best practices from a number of sources identified within a previously completed literature review (Dare, Geissler, Schott & Zhang, 2015). Due to the broad nature of the practitioner guideline, it can be utilized further to inform more technical guidance documents and can be integrated within class EA processes such as the Conservation Ontario Class EA or the Municipal Class EA.

1.1 Importance of the Practitioner Guideline

The development of this guidance document is in response to the local and global manifestation of climate change impacts on social and economic foundations, resulting in high economic and social costs. Historical data indicates that the province of Ontario is experiencing shifts in seasons, with shorter winters, earlier springs, and more intense precipitation events (Ministry of the Environment and Climate Change, 2015). EAs are completed for major projects which have the potential to be vulnerable to climate change events. It is therefore becoming an acknowledged area of concern in EA planning, and the need to incorporate climate change adaptation and mitigation into the phases of the EA processes is being discussed within the province of Ontario. Regulatory bodies within the Ontario context are in the initial stages of creating a legislative framework for the integration of climate change adaptation and mitigation into EAs. Currently, no formal guidelines for climate change considerations are present in the Ontario Environmental Assessment Act or the Ontario Ministry of the Environment and Climate Change (MOECC) Codes of Practice Guidelines for EAs. Although no regulatory guideline within the province exists, provincial authorities have identified climate change adaptation and mitigation as a priority, with the MOECC expressing an interest in updating the Codes of Practice Guidelines to include guidance for integrating climate change adaptation and mitigation into EAs (Government of Ontario, 2011). The province's *Climate Ready Ontario's Adaptation Strategy and Action Plan for 2011-2014* has set the integration of climate change into the Ontario EA process as one of the province's future goals, found in action item number 8 of the strategy (Government of Ontario, 2011).

This guideline provides an opportunity for EA practitioners to consider new means of designing and building a typical project. Considering climate change adaptation and mitigation will result in the much needed fundamental transformation of how we plan and build infrastructure in Ontario.

1.2 Intended Practitioner Guideline Use

The intended use of this guideline is to inform EA practitioners on best practices for the integration of climate change considerations into EAs. EA practitioners include those involved in the development of EAs and those who utilize EA documents. This guideline provides an opportunity for users to identify the potential vulnerabilities of their impact their project and how resilient it is to impacts of climate change. It allows practitioners to address climate change threats that are unique to their region through existing tools and technologies. It is recommended that project proponents consult with climate change professionals when integrating this guidance document into project planning.

BEST PRACTICE

1. Climate change considerations and adaptation and mitigation measures should be identified and integrated directly into all phases of the EA process. Proponents should avoid creating a separate document dedicated to climate change.

It is recommended that the guideline be reviewed in full prior to the initiation of an EA process. However, the practitioner guideline can be applied to a project after the EA process has been initiated if the project is determined to be vulnerable to climate change. It is intended to be used in conjunction with the *Ontario Environmental Assessment Act* and the existing Ontario Environmental Assessment guidance documents; *Consultation in Ontario's Environmental Assessment Process, Preparing and Reviewing Environmental Assessments in Ontario, Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario* (MOECC 2014a; MOECC, 2014b; MOECC, 2014c) (Appendix C-2).

This practitioner guideline does not supersede the regulations of the Ontario Environmental Assessment Act (the Act) (Appendix C-2), but provides recommended methods and approaches based on current best practices to be considered in conjunction with the existing regulations. Under the Act, proponents of a project must submit a Terms of Reference (ToR) document for approval to the MOECC prior to the start and completion of an EA (Environmental Assessment Act, 1990). The guideline follows the requirements for an EA as set out in the Act section 6.1 (1),(2), and section 9. Furthermore, the application of section 6.1 (3), permits the addition of other considerations, including those presented in this practitioner guideline to be addressed in both the ToR and EA.

> 6.1 (3). The approved terms of reference may provide that the environmental assessment consist of information other than that required by subsection (2). 1996, c. 27, s.3

This guideline is intended to inform both the development of the ToR and the EA and thus should be reviewed prior to the proponents' creation of the ToR.

1.3 Directions for Use and Organization of the Practitioner Guideline

It is recommended that this guideline be reviewed in full; however, this document has been divided into subsections to promote ease of use and, each subsection can be viewed independently. The intended application of each subsection is identified in the short descriptions below.

This guideline provides a detailed account of when and how climate change considerations should be employed throughout the phases of the Ontario EA process. This guideline builds on the identified best practices (Appendix A) to provide a practical framework for application of climate change considerations into EA processes. The identified phases of the Ontario EA process are based on the requirements of the Act and the potential for application of climate change considerations. In each phase, the relevant section of the Act is identified, and a brief explanation of the expectation of the phase is provided. A justification for why climate change should be considered is provided, as well as step by step guidelines for climate change integration. Reference to additional materials such as worksheets, found in Appendices B and C, is provided when appropriate.

Ontario Environmental Assessment Phases

- Phase 1 Statement of Purpose and Initial Considerations
    - Phase 1.1 Intended Purpose
    - Phase 1.2 Identification of Alternatives
- Phase 2 Scoping: Description of the Environment, Baseline Evaluation and Determining VECs
- Phase 3 Identifying Significant Impacts
- Phase 4 Cumulative Impacts
- Phase 5 Impact Management
- Phase 6 Monitoring and Commitments

Additional Considerations

In addition to the phases of the Ontario EA, Stakeholder Engagement and Uncertainty are identified as additional considerations. Stakeholder Engagement and Uncertainty are not associated with any one phase of the Ontario EA, therefore a summary of best practices are presented within each to be considered throughout the entire EA planning process.

- Stakeholder Engagement
- Uncertainty

Appendix A: Best Practices

General best practices are listed in Appendix A and provide an understanding of key considerations that should be utilized during the phases of the EA process. The best practices were informed from a number of sources identified within a previously completed literature review (Dare et al., 2015).

Appendix B: Worksheets

This guideline provides matrices and worksheets that will promote the practical application of the best practices. When appropriate, the user will be referred to this section for examples of matrices and worksheets. The worksheets are broad in nature, in order to be compatible with any project. Therefore, it is recommended that the worksheets be scoped specifically to the project in question for best results.

Appendix C: Additional Resources

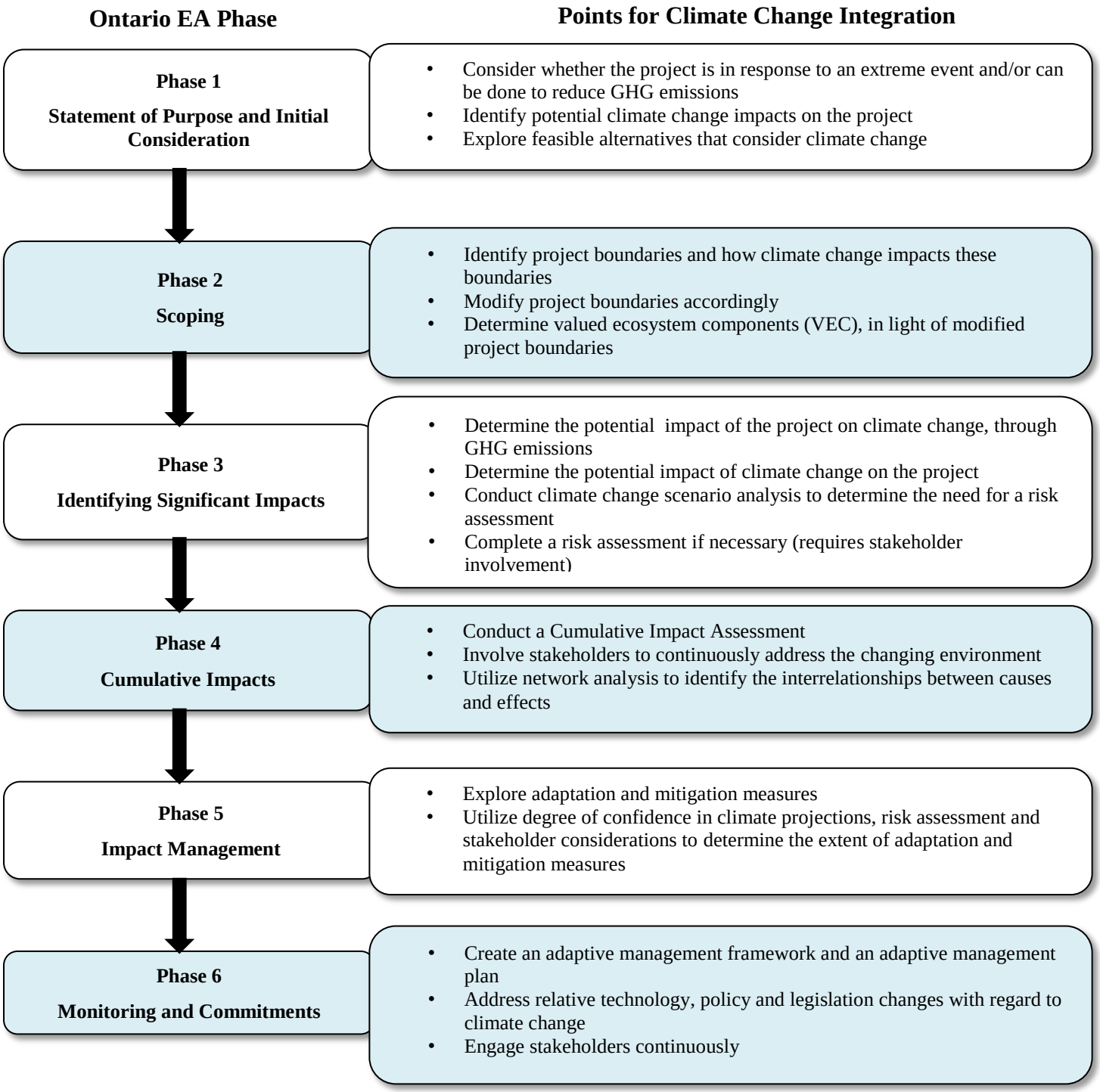
To provide the best available information, the guideline has developed a list of additional resources including other guidance documents and links to other external resources for further reference.

Appendix D: Case Study

A case study is presented to provide an example of how the practitioner guideline can be applied to a planning project in Ontario. The case study is an additional resource for better understanding of the practitioner guideline. The City of Toronto's proposed Allen Road ToR was utilized as a case study to determine the adaptability of the practitioner guideline. Due to the case study being a ToR, the guideline was able to demonstrate points for integration of climate change considerations when the proponent completes the EA. The project's design alternatives were found to be a key point of climate change integration through consideration of their relative greenhouse gas (GHG) emission contributions and the adaptation and mitigation measures within each of the designs.

2.0 Integration of Climate Change into the Phases of Ontario Environmental Assessment

Figure 1. Key Considerations for Integrating Climate Change into the Ontario EA Process



2.1 Phase 1 Statement of Purpose and Initial Considerations

2.1.1 Intended Purpose

Relevant Section of the Act

6.1(2) Subject to subsection (3), the environmental assessment must consist of,
(a) a description of the purpose of the undertaking

Requirements of the EA Phase

Within Statement of Purpose and Initial Considerations, the project proponent must clearly describe the proposed project. Questions to be answered by the proponent include: What is to be achieved by engaging in the EA process? Why does the proponent need to do this study or pursue the particular undertaking? The responses must be stated in terms of the projects intended effect on society, the problem it will solve or alleviate, or the opportunity the undertaking is to pursue. The Statement of Purpose is required to be general enough to allow for a range of alternatives to be considered. The Statement of Purpose is to be refined from the ToR throughout the planning process until presented in the final EA.

Importance of Considering Climate Change

It is important to consider climate change at an early stage in order to determine if and how climate change has provided a rationale for the project or components of the project. The project may be conducted either as a proactive or reactive response to climate change. Climate change may also influence the project's intended effect on society, the problem it will solve or alleviate, or the opportunity the undertaking is to pursue. Climate change should be considered because project rationale can influence the planning process, including identification of alternatives, and opportunities to add value to alternatives that might otherwise not have been considered (see Phase 5).

How to Integrate Climate Change

Step 1 Climate Change as Rationale

Climate change can be a rationale for a project for one of two reasons. Consider carefully if the proposed project,

1) has been prompted by an extreme weather event. Is the project in response to a flooding event that resulted from, heavy rainfall? For example, the proposed project is a road repair that is conducted in response to damage from precipitation events that can be attributed to climate change in the long-term.
2) will mitigate GHG emissions. Does the project provide alternative energy sources or an upgrade that will reduce GHG emissions? For example, the proposed

project is an addition to an existing project site that will decrease its GHG emissions by 20%.

If climate change is a rationale for the proposed project, it must be explicitly stated in the finalized Statement of Purpose in the EA.

Step 2 Climate Change Impact on Intended Purpose

Climate change can influence the project's intended effect on society, the problem it will solve, or the opportunity the undertaking is attempting to pursue. Identify if there is potential for climate change to impact the project's,

1) intended effect on society
2) intended purpose; ability to solve or alleviate the identified issue
3) ability to pursue the identified opportunity

If climate change can potentially influence any of the 3 identified factors that are required for completion of the Statement of Purpose, this must be acknowledged in the finalized Statement of Purpose in the EA. At this stage, climate change considerations are general in nature. In depth analysis of climate change impacts is pursued later in the process.

2.1.2 Identification of Alternatives

Relevant Section of the Act

6.1(2) Subject to subsection (3), the environmental assessment must consist of,
(b) a description of and a statement of the rationale for,
(i) the undertaking,
(ii) the alternative methods of carrying out the undertaking, and
(iii) the alternatives to the undertaking

Requirements of the EA Phase

Within Identifying Alternatives to the project undertaking the project proponent must provide a description of and rationale for the chosen undertaking. Proponents may begin the EA process before the undertaking is defined, in this case the description of the proposed undertaking is conceptual until an undertaking is selected from the alternatives after the alternatives have been considered and evaluated during the EA process. Proponents may also provide a detailed description of the undertaking in the ToR if the undertaking has been identified through previous planning studies. The Statement of Purpose is intentionally general to allow for consideration of alternatives to the proposed project. In the ToR the proponent must provide a range of alternatives to be analyzed in the EA. Alternatives can include alternatives to the proposed undertaking, and alternatives methods of carrying out the proposed undertaking.

How to Integrate Climate Change

The Ontario Government provides a number of considerations that the proponent must consider when identifying a reasonable range of alternatives during the EA process (Appendix C-1) (MOECC, 2014c). Climate change can be integrated within a number of the existing considerations identified, and it is recommended that the proponent do so. For example, the two existing considerations below are relevant for climate change and provide points for integration:

1) Are the alternatives consistent with other relevant planning objectives, policies and decisions (for example, Official Plans, Provincial Policy Statement, Growth Plans under the Places to Grow Act, 2005)?

> Climate change has been noted as a priority within the new Provincial Policy Statement, amended in 2014. In sections 1.6.1, 1.6.2 and 1.8.1 the statement identifies,
>
> 1.6.1: Infrastructure, electricity generation facilities and transmission and distribution systems, and public service facilities shall be provided in a coordinated, efficient and cost-effective manner that considers impacts from climate change which accommodating project needs.
> 1.6.2: Planning authorities should promote green infrastructure to complement infrastructure.
> 1.8.1: Planning authorities shall support energy conservation and efficiency, improved air quality, reduced greenhouse gas emissions, and climate change adaptation through land use and development patterns... (Ministry of Municipal Affairs and Housing, 2014).

2) Are the alternatives consistent with provincial government priority initiatives (for example, waste diversion, energy efficiency, source water protection, reducing GHG emissions)?

> Provincial authorities have identified climate change adaptation and mitigation as a strategic priority, the province's Climate Ready Ontario's Adaptation Strategy and Action Plan for 2011-2014 has set precedence for climate change considerations in provincial planning activities (Government of Ontario, 2011).

The considerations in Appendix C-1 are the minimum required. It is recommended that additional considerations that integrate climate change adaptation and mitigation be integrated at this stage. For example, the proponent can consider alternatives that utilize technologies and/or measures that mitigate and/or adapt to climate change.

BEST PRACTICE

2. The consideration of climate change adaptation and mitigation should be addressed as an aspect of the project description, regardless of existing regulatory guidelines, and should consider all current climate change policies that are relevant within the project's jurisdiction.

2.2 Phase 2 Scoping: Description of the Environment, Baseline Evaluation and Determining VECs

Relevant Section of the Act

(2) Subject to subsection (3), the environmental assessment must consist of,
(c) a description of,

(i) the environment that will be affected or that might reasonably be expected to be affected, directly or indirectly,
(ii) the effects that will be caused or that might reasonably be expected to be caused to the environment.

Requirements of the EA Phase

In Scoping, the proponent must define the study area in which the proposed project is to be located and must describe the existing environment within the study area. The description of the environment must include all components of the environment included in the Act's definition. The environment includes the social, cultural, economic, built and natural environment. Baseline assessment of the existing environment is a tool with which to determine the proposed projects VECs.

Importance of Considering Climate Change

When determining the VECs of the project, climate change should be considered within the different boundaries of the proposed project environment. Climate change may impact the spatial extent and boundaries of the site environment over time. Climate change may also impact the vulnerability of the environments, influencing the determined VECs and areas of potential environmental concern.

How to Integrate Climate Change

The description of the environment must include a description of the proposed project boundaries. This is a natural place to integrate climate change considerations. Figure 2 describes the types of boundaries and considerations for climate change adaptation and mitigation. VECs are determined through description of the environment's baseline and its boundaries. Climate change can impact the spatial and temporal boundaries of the environment and the vulnerability of the environment. Both considerations should be reflected in the identification of the VECs. It should be noted that considerations of climate change are not likely to significantly change which VECs are identified (Nova Scotia Environment, 2011) but may change their scope, significance and vulnerability to impacts (see Phase 3).

Figure 2. Climate Change Considerations in Scoping Environment Boundaries and VECs

Environment Type	Boundary Description	Boundary Considerations for Climate Change	Determination of VEC
Spatial and Temporal Boundaries of the proposed project and its activities	Location of the proposed project's physical site and consideration of the spatial and temporal scales of the projects impacts.	Climate change may influence the spatial and temporal scale of the proposed project's impacts. Consider that those environments may have longer lifespans than the proposed project. Impacts of the project may go beyond the spatial and temporal scale of the project and its activities.	Changes to the scale of the proposed projects spatial and temporal impacts due to climate changes may influence the location and scope of the determined VEC.
Spatial and Temporal Boundaries of the natural environment	Consideration of the natural and ecological systems.	The effects of climate change may influence the spatial and temporal boundaries of the natural environment, and therefore its impacts on the project.	Changes to the spatial and temporal scale of the natural environment boundaries due to climate changes may change the location at which VECs are considered.
Administrative, social, economic, built and cultural environment	Boundaries imposed by political and regulatory frameworks, and social awareness, influencing required and recommended practices.	Identify and apply any new, or amended, previously established regulatory frameworks to address the management of climate change. Include climate change considerations within the scope of public consultation, to meet demands of a growing social environment.	Increased social/public interest in climate change, and regulatory requirements regarding climate change considerations should impact the determination of the VECs.
Technical Boundaries	Limitations of measurement and projection methods, including availability of data and the cost to gather and assess information. Lack of reliability when using historical climate data to make future predictions.	Acknowledge uncertainty in measurements of the current environment and in projections of the future state of the environment. Determine acceptable levels of uncertainty regarding climate change.	Acknowledge uncertainty in the ability to determine VECS. Proponents should integrate flexibility and adaptability into the determination of VECs allowing for the addition and modification of VECs throughout the project lifecycle. Changes to VECs may result from climate change data becoming more sophisticated throughout the lifetime of the project.

Steps to integrate climate change considerations into the description of the environment and in the determination of project VECs are below. Climate change considerations can modify the existing VECs identified by the proponent, and can identify additional VECs.

Step 1 Determine if Identified VECs may be affected by Climate Change

Worksheet 1 in Appendix B-1 provides an example of how a proponent may examine the potential changes to identified VECs in light of climate change impacts. If there are no anticipated modifications to VECs as a result of climate change considerations, provide rationale as to why or why not.

Step 1.1 Modify VECs

Identify all VECs that may be impacted by climate change, consider modifying the scope of VEC to reflect this. This consideration will be important for determining the significance of the VEC (see Phase 3).

Step 2 Identify Additional VECs

Identify any VECs that can and should be included based on considerations environment boundary changes as a result of climate change influences. Apply Worksheet 2 in Appendix B-1 to environment boundaries. Determination and modification of VECs should be an iterative process that includes considerations of climate change throughout project life; considerations should be made to extend VEC analysis past the project lifetime. Newly identified VECs from Worksheet 2, should be examined further through use of Worksheet 1.

A full list of identified VECs should be made by combining VECs identified and modified in both Worksheets 1 and 2 (Appendix B-1).

2.3 Phase 3 Identifying Significant Impacts

Relevant Section of the Act

6.1(2) Subject to subsection (3), the environmental assessment must consist of,
(c) a description of,

(i) the environment that will be affected or that might reasonably be expected to be affected, directly or indirectly,
(ii) the effects that will be caused or that might reasonably be expected to be caused to the environment,

Requirements of the EA Phase

Under the Act, once the baseline assessment is completed, and the environmental boundaries and VECs are determined, the proponent must evaluate the effects to the VECs from the proposed project alternatives. All potential positive and negative direct and indirect effects from the project must be identified and examined.

Importance of Considering Climate Change

As project activities that intensify climatic change will impact the environment and the project in the future, those activities must be assessed. The sensitivity of the project, environment and the identified VECs to future climate change must be determined. Climate change can influence two types of impacts, as outlined in Best Practice 3. When determining the impacts of the project, the EA should address the potential impact of climate change on the project, and the potential impact of the project on climate change (greenhouse gas emissions). While determining the impacts to climate change and the impacts of climate change is not a required step of the Act, it is identified as a best practice for EAs.

BEST PRACTICE

3. When determining the impacts of the project, the EA should address the potential impact of climate change on the project; and the potential impact of the project on climate change (greenhouse gas emissions).

How to Integrate Climate Change

In Phase 2, VECs were scoped based on,
1) the spatial and temporal boundaries of the project

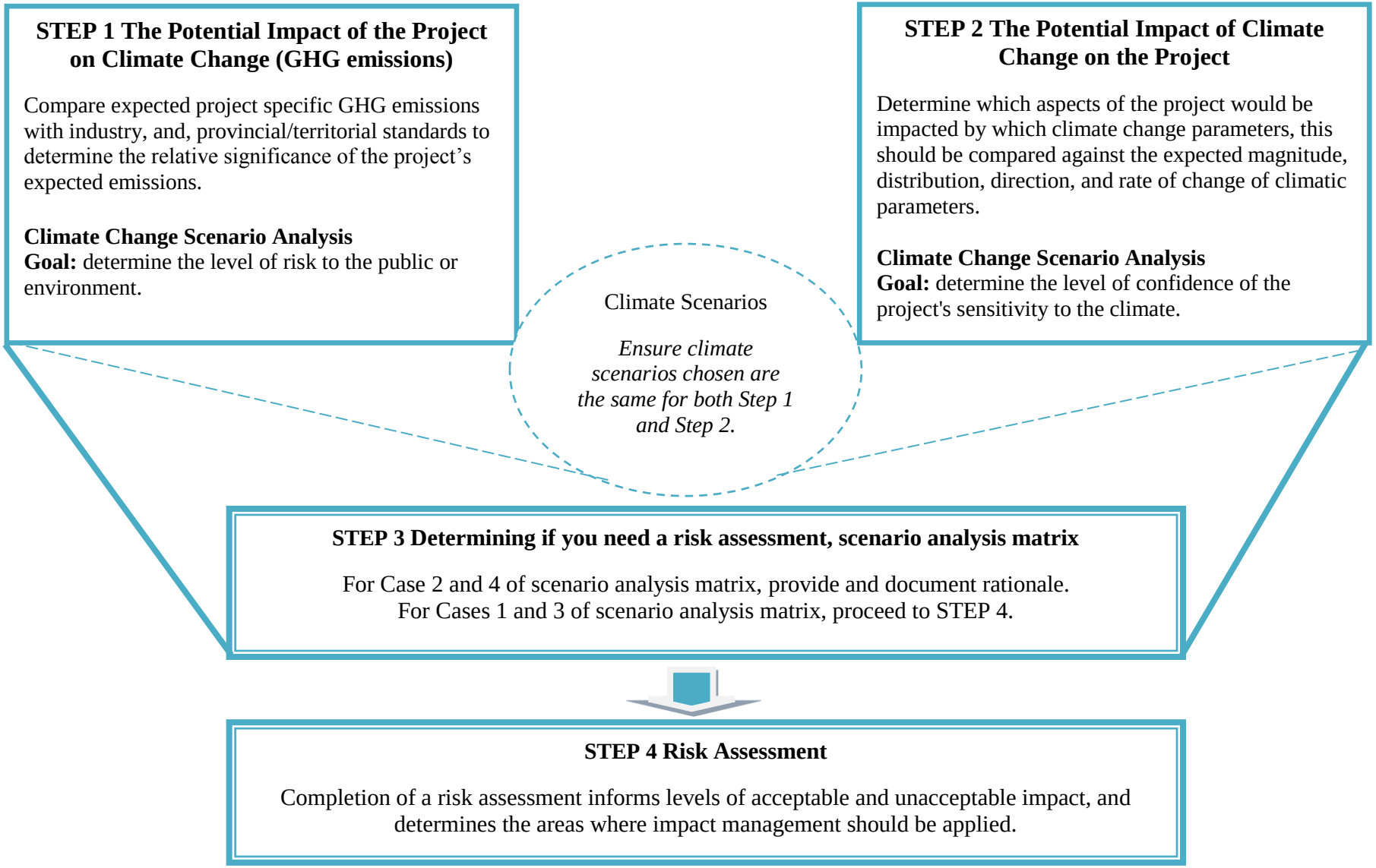
- Note: the project can impact the surrounding environment, through GHG emissions, that lead to intensified climate change.

2) the spatial and temporal boundaries of the natural environment

- Note: changes to the natural, social, economic, built and cultural environments, because of climate change, will impact the project.

Figure 3 provides a graphic representation of the steps of Phase 3. Steps 1 and 2 can be completed in conjunction with one another, and should utilize the same climate scenarios. Step 3 utilizes a scenario analysis matrix to determine if Step 4 is required.

Figure 3. Phase 3 Steps: Identifying Significant Impacts



Step 1 The Potential Impact of the Project on Climate Change (GHG emissions)

To determine the proposed project's impacts on climate change through the release of GHG emissions the proponent should:

- incorporate jurisdictional regulatory and planning considerations into assessing the project impacts, such as GHG-related policies, plans and programs;
- determine industry and project-specific GHG standards and regulations;
- assess and record the expected type, magnitude, intensity and timing of project GHG emissions;
- compare expected project specific GHG emissions with industry, and, provincial/territorial standards to determine the relative significance of the project's expected emissions; and,
- should not compare project rate of emissions with national rate of emissions, this will not provide an accurate level of significance.

Provincial and industry standards represent the minimum requirements with which GHG emissions can be benchmarked for significance. It is encouraged that proponents attempt to meet and exceed GHG emission standards to reduce the significance of the project's impact.

Step 1.1 Climate Change Scenario Analysis

Goal: to determine the level of risk to the public or environment

Once the proponent has assessed and determined the expected type, magnitude, intensity and timing of project GHG emissions, climate change scenarios should be created. Climate change scenarios will enable the proponent to determine potential future states of climate change and the subsequent impacts of that climatic change on the environment and public. The selection of climate change scenarios should be based on the requirements of Step 1 and Step 2 of Phase 3, as well as the best practices below.

BEST PRACTICE

4. When determining the impacts of the project on climate change, clearly defined qualitative and quantitative data should be provided regarding GHG emissions, over the life-time of a project. The emissions should be compared against regional government or industry reduction targets, not national rates of emissions. Significance of GHG emissions should be determined using a reasoned argumentation approach that integrates scientific and local knowledge with qualitative and quantitative data.

Best practices for creating climate change scenarios for project impacts include:

- choosing effective scenario variables (temperature indices, precipitation indices, emissions etc.);
- the climate variables chosen within the scenarios should be dependent on the expected type, magnitude, intensity and timing of the project's GHG emissions;
- additionally the climate variables chosen should reflect the project's environmental impacts of concern (i.e. the VECs of concern established in Phase 2);
- choosing an adequate number of climate scenarios to create;
- the number of scenarios to be created and examined should be reduced to scenarios that represent possible climatic ranges within the proposed project's location/environment; and,
- multiple scenarios that capture a range of potential future climates should be created. There should be scenarios representing extreme ranges of climate variables as well as intermediate scenarios in which climate variables do not change drastically from historical averages.

BEST PRACTICE

5. When identifying the impacts of the project on climate change, and the impacts of the environment of the project, at least three climate change projections should be produced using the best scientific information. These projections should be based on an assessment of the baseline environment and scenario analysis beyond simple historical climate data that includes scientific, local and traditional knowledge.

Step 2 Potential Impact of Climate Change on the Project

To determine the impacts of climate change on the proposed project, the proponent must:

- identify the sensitivity of the project from changes in climatic parameters (e.g., rainfall);
- collect regional climate change data and determine the relationship to the project's-specific sensitivities; and,
- assess and record the magnitude, distribution, direction, and rate of change of climatic parameters.

Step 2.1 Identify the Sensitivity of the Project from Differing Climatic Parameters

Sensitivity analyses identify the areas of vulnerability in a project to determine which climate change impacts may influence these vulnerabilities. Sensitivity analyses look at "what if" questions such as, if parameter x changed by y amount, what would be the resulting impact? And, what change in variable x would cause a level y of impact? It is recommended that the proponent produce "what if" questions, to the extent possible, for all climate change parameters and the related impacts on project components (Byer & Yeomans, 2007; Byer, Lalani, & Yeomans, 2009; Colombo & Byer, 2012). Worksheet 3 in Appendix B-2 can be used to establish

climatic parameters and their impacts on project components. This worksheet should be utilized as a template and further tailored to represent the proposed project.

Step 2.2 Climate Change Scenario Analysis

Goal: to determine the level of confidence of the project's sensitivity to the climate change parameters

Once the proponent has determined, 1) the climate parameters that have the potential to impact the project and, 2) which aspects of the project would be impacted by which climate change parameters, this should be compared against the expected magnitude, distribution, direction, and rate of change of climatic parameters. Climate change scenarios will enable the proponent to determine potential future states of climate change and the level of confidence that the project will be sensitive to climate change parameters.

Best practices for creating climate change scenarios to determine the sensitivity of the project to climate change includes:

1) Choosing effective scenario variables (temperature, precipitation, emissions etc.)

- The climate variables chosen within the scenarios should be dependent on the expected type, magnitude, intensity and timing of the project's GHG emissions.
- Additionally the climate variables chosen should reflect the project's environmental impacts of concern (i.e. the VECs of concern established in Phase 2).

2) Choosing an adequate number of climate scenarios to create

- The number of scenarios to be created and examined should be reduced to scenarios that represent possible climatic ranges within the proposed project's location/environment.
- Multiple scenarios that capture a range of potential future climates should be created. There should be scenarios representing extreme ranges of climate variables as well as intermediate scenarios in which climate variables do not change drastically from historical averages.

<u>Step 3 Determining if you need a risk assessment, scenario analysis matrix</u>

For each scenario identified the proponent must determine if a climate change risk assessment should be conducted. A scenario matrix should be used to determine the need for a risk assessment. The scenario matrix is as shown below Figure 4. For each climate change scenario, the degree of risk of the project on the environment and the level of confidence in the proposed project's sensitivities to climate change parameters should have been determined in Step 1 and Step 2 respectively. Determine if a risk assessment should be conducted, for example, if there is a high level of confidence that the climate scenario will impact the project, and a high risk to the

environment, please follow to Step 4. For any scenario in which a risk assessment is not necessary, provide and document rationale as to why not.

Figure 4. Scenario Matrix for Determining Requirement of Risk Assessment

		Phase 3 Step 1 Potential Impact of the Project on Climate Change	
		High Risk • of there being impacts to the natural, built, economic, social, or cultural environment from the climate change scenario	Low Risk • of there being impacts to the natural, built, economic, social, or cultural environment from the climate change scenario
Phase 3 Step 2 Potential Impact of Climate Change on the Project	High Confidence Level • that the project is sensitive to the scenario's climate change parameters	Case 1 • complete a risk assessment	Case 2 • risk assessment for project can be optional
	Low Confidence Level • that the project is sensitive to the scenario's climate change parameters	Case 3 • complete a risk assessment • emphasize the uncertainty in the climate change scenario	Case 4 • no risk assessment is required

(Figure adapted from Bell, Collins & Young, 2003; Federal/Provincial/Territorial Committee on Climate Change & Environmental Assessment, 2003)

Step 4 Risk Assessment

Once scenario analyses have been created, (Step 1 and 2) a risk assessment may be deemed appropriate through use of the scenario matrix (Step 3). Risk assessments are a best practice for determining the degree of risk associated with a climate change scenario. Completion of a risk assessment informs levels of acceptable and unacceptable impact as well as determining the areas where impact management should be applied. Risk assessments are a common EA practice and their application towards addressing climate change risks utilizes the same general framework.

To the extent possible, the risk assessment should follow the prescribed best practice,

BEST PRACTICE

6. Risk assessment approaches should be utilized for effective decision making when determining the significance of identified impacts. Risk assessment approaches and climate change predictions should be supplemented with explanation and justification for decisions, including reference to the degree of confidence held and uncertainty held.

It should be noted that risk assessments can be used to further refine and scope the VECs. Phases 2-3 should be used iteratively. The general steps of a risk assessment are depicted in Figure 5.

Figure 5. Steps of Risk Assessment

Initiation ● Define problem and associated risk issue(s) ● Identify potential stakeholders ● Begin consultation
Preliminary Analysis ● Define scope of the decision(s) ● Identify hazards using risk scenarios ● Begin stakeholder analysis ● Start the risk information library
Risk Estimation ● Define methodology for frequency and consequences ● Estimate frequency of risk scenarios ● Estimate consequences of risk scenarios ● Refine stakeholder analysis through dialogue
Risk Evaluation ● Estimate and integrate benefits and costs ● Assess stakeholder acceptance of risk
Take action in EA Phase 5 and Phase 6

(Figure adapted from Bell et al., 2003)

Management and monitoring of identified climate change risk is addressed in Phase 5: Impact Management and Phase 6: Monitoring and Commitments.

Additional guidance on the production and use of risk assessments can be found in the Canadian Standards Association Risk Analysis Requirements and Guidelines, and Risk Management: Guideline for Decision Makers (Appendix C-2).

2.4 Phase 4 Cumulative Impacts

Relevant Section of the Act

Examination of cumulative impacts is not a requirement of the Act. It is however, outlined in the MOECC guidance document (MOECC, 2014c) as a best practice for conducting EA.

The MOECC (2014c) recommends that information regarding cumulative effects include a combination of past, present and future activities of the project and already-approved projects to be built in the future. Assessments can be either quantitative, if data is available from government agencies, or qualitative and should adequately assess potential cumulative impacts to the extent possible.

Importance of Considering Climate Change

Cumulative impact assessment is not a requirement of the Act. However, due to the long-term nature of climate change, it is important to undertake an evaluation of cumulative impacts. The cumulative effects of climate change impacts can introduce high uncertainty for the prediction of climate change impacts at the regional level (Byer et al., 2009). In spite of the challenges associated with predicting climate change, failure to consider the cumulative impacts of the project may add high costs to the project, including both high socio-economic and/or environmental costs (Byer & Yeomans, 2007). The cumulative and temporal scale of climate change does not adequately align with the temporal scale of project level EAs; therefore producing a cumulative impact assessment is a method to consolidate those differences.

How to Integrate Climate Change

It should be acknowledged that when climate change is considered a cumulative impact by EA practitioners, the challenges associated with cumulative impacts are also relevant. These challenges include: insufficient methods and understanding of cumulative impact assessments, uncertainty regarding cumulative impacts, and inconsistent guidance (Slotterback, 2011).

To overcome the problem associated with inconsistent guidance, the guideline prescribes the use of the Federal Cumulative Effects Assessment Practitioner's Guide (Appendix C-2).

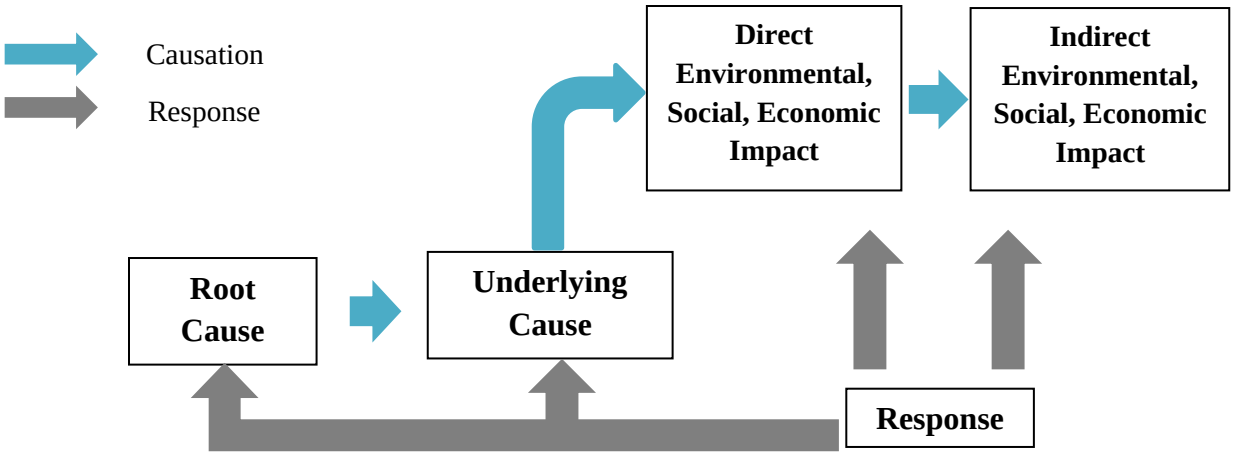
When conducting a Cumulative Impact Assessment the cumulative impacts of the project, and other existing or planned projects, on the environment must be considered in conjunction with consideration of the cumulative impacts of the environment and climate change on the project.

It is recommended that the practitioner use the best available knowledge and analysis tools of climate change to extend monitoring and analysis of the VECs outside of the general regional

spatial scope and beyond the temporal scope of the project. Cumulative effects should be considered as early as possible within the EA process. The state of the environment is not static, the future states may not be equivalent to the current state, and therefore cumulative impacts should be continuously examined beyond the temporal scope of the project lifespan and should acknowledge the dynamic of a changing environment.

Best practices for analyzing cumulative effects include the use of causal chains or network analyses to understand the interactions and associated cumulative effects between the project, the environment, and climate change (European Commission, 2013). An example of a causal chain is presented in Figure 6 below and it is recommended that public stakeholder engagement be used to help identify potential chains of cumulative impacts.

Figure 6. Exemplar Causal Chain Diagram



Causal chains are an ordered sequence of events linking a problem's causes to the effects, visualizing cumulative impacts

2.5 Phase 5 Impact Management

Relevant Section of the Act

6.1(2) Subject to subsection (3), the environmental assessment must consist of,
(c) a description of,
(iii) the actions necessary or that may reasonably be expected to be necessary to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment,
by the undertaking, the alternative methods of carrying out the undertaking and the alternatives to the undertaking;
(d) an evaluation of the advantages and disadvantages to the environment of the undertaking, the alternative methods of carrying out the undertaking and the alternatives to the undertaking;

Requirements of the EA Phase

Under the Act, the project proponent must provide a description of the how they will minimize or prevent the risks or negative environmental effects while enhancing the positive environmental effects of the proposed project.

Importance of Considering Climate Change

The risks posed by climate change to the project, environment or VECs need to be addressed in the same manner as any other type of risk. Furthermore, impacts from the project contributing to potential future climate change must also be addressed to reduce the impacts of that climate change on the project, environment or identified VECs. Within this phase, the identified climate positive impacts of the proposed project should be enhanced where possible.

How to Integrate Climate Change

BEST PRACTICE

7. Climate change adaptation and mitigation measures should be considered based on a life-cycle assessment of the project when addressing impacts of the project on climate change, and the impacts of the environment of the project.

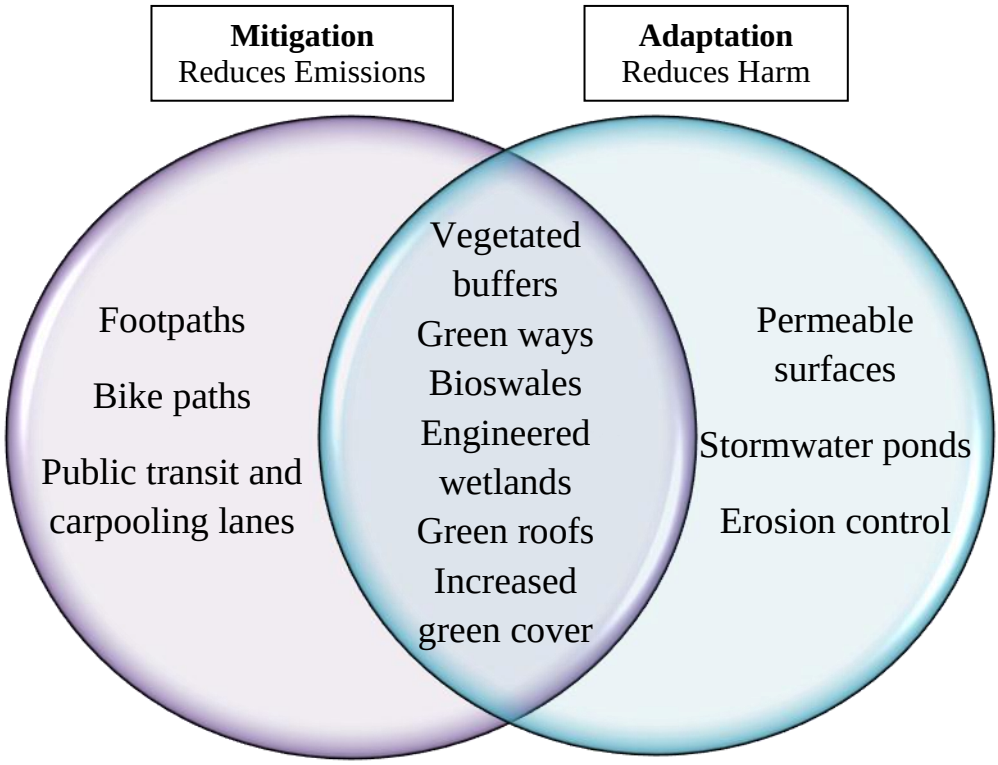
Risks and negative impacts identified in the risk assessment should be directly addressed through adaptation and mitigation measures. Adaptation is defined as, "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (Pachauri & Reisinger, 2007, p.869). The main goal of adaptation is to alleviate and reduce current sensitivity and vulnerability to climate-related crises to increase resiliency of communities (Natural Resources Canada, 2008). Mitigation moderates the magnitude and rate of climate change, affecting the demands for extensive adaptation under greater magnitudes of change (NRC, 2008). While there is a

distinction between mitigation and adaptation, these two terms can also be inter-related. Strategies can be used to achieve mitigation and adaptation objectives at the same time. Figure 7 illustrates adaptation and mitigation strategies in the context of green infrastructure that may have relevance for the proposed project. Consider strategies, whether green infrastructure or not, that can accomplish both adaptation and mitigation.

BEST PRACTICE

8. EAs should utilize strategies, such as green infrastructure, that accomplish both adaptation and mitigation when attempting to manage the impacts of a project.

Figure 7. Green Infrastructure Adaptation and Mitigation Strategies



Adaptation measures should be utilized when the impacts to the environment and project are unavoidable, whereas mitigation measures should be utilized to avoid the impacts to the environment and the project when, if they should occur, they are unmanageable. It is additionally, a best practice to utilize measures that help achieve both mitigation and adaptation objectives. This provides a functional redundancy and cost savings, because all levels of confidence and uncertainty can be managed under a single measure.

BEST PRACTICE

9. Decisions regarding the application of climate change adaptation and mitigation practices, during impact mitigation efforts, should be based on the precautionary principle of "do no harm".

ADAPT to manage the unavoidable

MITIGATE to avoid the unmanageable

The degree of confidence in climate projections, risk assessments and stakeholder considerations, should be used to determine the extent of adaptation and mitigation measures. The proponent is faced with two options: 1) implement more adaptation and mitigation measures if there is greater uncertainty and less confidence or, 2) implement fewer adaptation and mitigation measures if there is less uncertainty and greater confidence. Proponents should justify their choice with the stakeholders and document rationale within the Impact Management section of the EA.

BEST PRACTICE

10. The extent of adaptation and mitigation measures proposed for any project should depend of the extent of uncertainties regarding climate change impacts and future impact to climate change determined during the EA of the project.

Byer, Colombo, Sabelli, & Ches (2011) *Decision making under uncertainties for adapting to climate change in project environmental assessments*, and Colombo and Byer (2012) *Adaptation, flexibility and project decision-making with climate change uncertainties*, provide additional information on broad commonly used adaptation and mitigation measures (Appendix C-2).

2.6 Phase 6 Monitoring and Commitments

Relevant Section of the Act

6.1(2) Subject to subsection (3), the environmental assessment must consist of,
(c) a description of,

(iii) the actions necessary or that may reasonably be expected to be necessary to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment,

9. (1) The Minister may decide an application and, with the approval of the Lieutenant Governor in Council or of such ministers of the Crown as the Lieutenant Governor in Council may designate, the Minister may,
(b) give approval to proceed with the undertaking subject to such conditions as the Minister considers necessary to carry out the purpose of this Act and in particular requiring or specifying,

(ii) the works or actions to prevent, mitigate or remedy effects of the undertaking on the environment,

(iii) such research, investigations, studies and monitoring programs related to the undertaking, and reports thereof, as the Minister considers necessary

Requirements of the EA Phase

The Act does not designate monitoring and commitments after project approval as a requirement within the EA; however, monitoring is a best practice for successful mitigation which is outlined in 2(c)(iii). Establishment of monitoring programs may be required if the Minister deems it to be a requirement for EA approval as outlined in 9(1)(b)iii. Furthermore additional commitments to prevent or mitigate the effects of the project on the environment after project construction is not required in the Act, however may be required if the Minister deems it to be a requirement for EA approval as outlined in 9(1)(b)ii.

Importance of Considering Climate Change

The future environment may differ from the current environment, therefore mitigation and adaptation measures applied to reduce the impacts from and to the project may become less efficient or relevant as climate change influences the state of the environment. Monitoring and commitments are an integral part of an adaptive management framework, which is a primary tool to combat climate change uncertainty.

How to Integrate Climate Change

Step 1 Adaptive Management

Create an adaptive management framework and an adaptive management plan, wherein monitoring is used to determine the effectiveness of adaptation and mitigation measures applied and can monitor and determine the state of the environment and VECs to inform additional adaptation and mitigation actions as required. Implement remedial actions as necessary and incorporate lessons learned and climate change data obtained from monitoring into regular project procedures.

BEST PRACTICE

11. If a project is deemed vulnerable to climate change an adaptation or 'adaptive management' plan should be produced that is focused on risk reduction, the application of no regrets measures, the long-term nature of climate change, and the uncertain nature of climate-change.

Step 1.2 Acknowledge Changes in the Field of Climate Change

Address and integrate evolving climate change knowledge, technology, and policy and legislation changes regarding climate change considerations into project activities/processes.

Step 1.3 Continue Stakeholder Engagement

Continue commitments towards stakeholder engagement after EA approval. Stakeholders can inform, or be a source of, future climate change data required for monitoring purposes

3.0 Additional Considerations

3.1 Stakeholder Engagement

Relevant Section of the Act

6.1(2) Subject to subsection (3), the environmental assessment must consist of,
(e) a description of any consultation about the undertaking by the proponent and the results of the consultation. 1996, c. 27, s. 3.

Requirements of the EA Phase

Consultation and documentation of consultation is a requirement in the Act, consultation however, is a less comprehensive process than stakeholder engagement. Stakeholder engagement is not a requirement of the Act however, it is outlined in the MOECC guidance document (MOECC, 2014c), as a best practice for conducting EA. The MOECC (2014c) recommends that there should be ongoing engagement with the public as part of environmental decision making. Engagement should be meaningful consultation with all interested persons to identify and respond to needs and concerns. It is best practice to have ongoing stakeholder engagement throughout the EA process and throughout the lifespan of the project.

Importance of Considering Climate Change

Stakeholder engagement is a necessary consideration for the integration of climate change adaptation and mitigation into EAs. Recognized justifications for stakeholder engagement include, 1) local and traditional ecological knowledge (TEK) will provide useful input for risk identification, and climate change mitigation and adaptation efforts, 2) there is a lack of stakeholder knowledge regarding climate change and how it can affect and be affected by a project (Sok, Boruff & Morison-Saunders,. 2011). It is important to ensure that all stakeholders understand climate change and how it is being addressed by the EA (Byer et al., 2012). Stakeholder engagement in regards to climate change considerations should be integrated in all phases of the EA (Figure 8).

Stakeholder engagement should be considered throughout the entire Ontario EA process. Steps for integration into each phase are identified in Figure 8. Additionally, reference to associated best practices is made when appropriate.

How to Integrate Climate Change

Figure 8. Key Areas for Stakeholder Engagement Integration into the Ontario EA Process

Phase 1 Statement of Purpose

- Identify stakeholders that;
  - have knowledge of climate change relevant to the project boundaries (refer to Best Practice 12);
  - will benefit if the project mitigates the impacts of climate change; and,
  - will be impacted if the project contributes to climate change.

Phase 2 Scoping

- If modifications to boundaries are made within the scoping process, reassess the stakeholders identified in Phase 1.
- Stakeholders, specifically those with TEK, can identify which VECs are most vulnerable to climate change.

Phase 3 Identifying Significant Impacts

- Stakeholder knowledge, specifically TEK, can aid in determining the degree of VEC vulnerability to climate change.
- Stakeholder knowledge, specifically TEK, can provide historical climate data for use in scenario modeling.
- Stakeholders can aid in determining the significance of climate change impacts on the stakeholders themselves (i.e. are they susceptible to impacts from both climate change and the project).
- Choice of methods to determine acceptable levels of climate change uncertainty should reflect stakeholder attitudes towards risk and significance of impacts (i.e. if stakeholders are risk adverse). Understanding stakeholder attitude towards climate change risk aids in justifying decisions made, producing a strong stakeholder relationship with minimal conflict.
- Ensure all stakeholders, regardless of existing climate change knowledge, be provided with a basic understanding of climate change and be provided with knowledge regarding, 1) the technical results of climate change impact scenarios, and 2) the scientific degree of belief in and acceptance in the climate change projections utilized. This will ensure that all stakeholders can make informed contributions producing a strong stakeholder relationship with minimal conflict (refer to Best Practice 13).

Phase 4 Cumulative Impacts

- Stakeholders can aid in identifying the cumulative inter-relationships between the environment, climate change and the project.

Phase 5 Impact Management

- Stakeholders can inform on the methods used to address climate change uncertainty and adaptation/mitigation measures.

Phase 6 Monitoring and Commitments

- Stakeholders can inform on, or be a source of, future climate change data required for monitoring purposes (refer to Best Practice 14).

BEST PRACTICE

12. Stakeholder knowledge of climate change should be considered throughout all phases of the EA process. The best available climate change knowledge should be utilized when determining climate change scenarios, the impacts of climate change on the project and impacts of the project on the climate.

13. Prior to the imitation of the EA, a stakeholder engagement process should be created that is focused on understanding climate change and uncertainty and promoting opportunities for positive engagement.

14. Throughout stakeholder engagement exercises, EA practitioners should encourage and work with local organizations pursuing adaptation and sustainability strategies.

For more detailed guidance on integrating TEK into adaptive management and Environmental Assessments, refer to Crawford, Wehkamp and Smith (2009), *Translation of Indigenous Western Science Perspectives on Adaptive Management for Environmental Assessments* (Appendix C-2).

3.2 Uncertainty

There are two sources of uncertainty during project planning; uncertainties about the future conditions of the climate, and uncertainties from modeling future climate at the regional project level from historical data. When the impacts to the environment and the impacts from the environment are uncertain project proponents should explain the nature of the uncertainty and how it has been addressed. Uncertainty should be considered and documented throughout the EA process to aid in making informed decisions about VEC selection, and to aid in informing risk analysis and impact management decisions.

BEST PRACTICE

15. Address uncertainty early within the process and continually re-evaluate the vulnerability of the project throughout its lifecycle.

Byer et al., (2011), *Decision making under uncertainties for adapting to climate change in project environmental assessments*, Byer et al., (2009), *Addressing and communicating climate change and its uncertainties in project environmental impact assessments*, Byer & Yeomans, (2007), *Methods for addressing climate change uncertainties in project environmental impact assessments* and Colombo & Byer, (2012), *Adaptation, flexibility and project decision-making with climate change uncertainties*, provide additional information on measures and considerations to make when dealing with the inherent uncertainty of climate change (Appendix C-2).

4.0 Conclusion

This guideline is intended to inform EA practitioners on best practices for the integration of climate change consideration into EAs. This guideline assists users in identifying the vulnerabilities and verifying the resiliency of their projects. It allows practitioners to address climate change threats that are unique to their region and project through existing tools and technologies.

As an EA practitioner, it is recommended that the document is reviewed in full prior to the initiation of the EA process. However, the guideline can be applied if the EA process has been initiated and the project is determined to be vulnerable to climate change. It is also intended to be used in conjunction with the Ontario Environmental Assessment Act (EAA, 1990) and the existing Ontario Environmental Assessment Guidance Documents; *Consultation in Ontario's Environmental Assessment Process, Preparing and Reviewing Environmental Assessments in Ontario, Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario* (MOECC 2014a; MOECC, 2014b; MOECC, 2014c), and with the additional supporting documents provided in Appendix C.

This guideline does not supersede the regulations of the Ontario Environmental Assessment Act but provides recommended methods and approaches based on current best practices. This guideline is intended to inform both the development of the ToR and the EA and thus should be reviewed prior to the proponent's creation of the ToR.

It is acknowledged that EA regulations and EA best practices are continuously changing processes, EA practitioners are advised to use this document in conjunction with the most up to date regulations and research.

5.0 References

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Appendix A Best Practices

Best Practice 1: Climate change considerations and adaptation and mitigation measures should be identified and integrated directly into all phases of the EA process. Proponents should avoid creating a separate document dedicated to climate change.

Best Practice 2: The consideration of climate change adaptation and mitigation should be addressed as an aspect of the project description, regardless of existing regulatory guidelines, and should consider all current climate change policies that are relevant within the project's jurisdiction.

Best Practice 3: When determining the impacts of the project, the EA should address, the potential impact of climate change on the project; and the potential impact of the project on climate change (greenhouse gas emissions).

Best Practice 4: When determining the impacts of the project on climate change, clearly defined qualitative and quantitative data should be provided regarding GHG emissions, over the life-time of a project. The emissions should be compared against regional government or industry reduction targets, not national rates of emissions. Significance of GHG emissions should be determined using a reasoned argumentation approach that integrates scientific and local knowledge with qualitative and quantitative data.

Best Practice 5: When identifying the impacts of the project on climate change, and the impacts of the environment of the project, at least three climate change projections should be produced using the best scientific information. These projections should be based on an assessment of the baseline environment and scenario analysis beyond simple historical climate data that includes scientific, local and traditional knowledge.

Best Practice 6: Risk assessment approaches should be utilized for effective decision making when determining the significance of identified impacts. Risk assessment approaches and climate change predictions should be supplemented with explanation and justification for decisions, including reference to the degree of confidence held and uncertainty held.

Best Practice 7: Climate change adaptation and mitigation measures should be considered based on a life-cycle assessment of the project when addressing impacts of the project on climate change, and the impacts of the environment of the project.

Best Practice 8: EAs should utilize strategies, such as green infrastructure, that accomplish both adaptation and mitigation when attempting to manage the impacts of a project.

Best Practice 9: Decisions regarding the application of climate change adaptation and mitigation practices, during impact mitigation efforts, should be based on the precautionary principle of "do no harm".

Best Practice 10: The extent of adaptation and mitigation measures proposed for any project should depend of the extent of uncertainties regarding climate change impacts and future impact to climate change determined during the EA of the project.

Best Practice 11: If a project is deemed vulnerable to climate change an adaptation or 'adaptive management' plan should be produced that is focused on risk reduction, the application of no regrets measures, the long-term nature of climate change, and the uncertain nature of climate-change.

Best Practice 12: Stakeholder knowledge of climate change should be considered, throughout all phases of the EA process. The best available climate change knowledge should be utilized when determining climate change scenarios, the impacts of climate change on the project and impacts of the project on the climate.

Best Practice 13: Prior to the initiation of the EA, a stakeholder engagement process should be created that is focused on understanding climate change and uncertainty and promoting opportunities for positive engagement.

Best Practice 14: Throughout stakeholder engagement exercises, EA practitioners should encourage and work with local organizations pursuing adaptation and sustainability strategies.

Best Practice 15: Address uncertainty early within the process and continually re-evaluate the vulnerability of the project throughout its lifecycle.

Appendix B Worksheets

Appendix B-1: Climate Change considerations for scoping environment boundaries and VECs

Steps for integrating climate change considerations into the description of the environment and in the determination of project VECs are below. Climate change considerations can modify the existing VECs identified by the proponent, and can identify additional VECs.

Step 1 Determine if Identified VECs may be affected by Climate Change

Worksheet 1 provides an example of how a proponent may examine the potential changes to identified VECs in light of climate change impacts. If there are no anticipated modifications to VECs as a result of climate change considerations provide rationale as to why or why not.

Worksheet 1. This worksheet provides an example of how a proponent may examine the potential changes to identified VECs in light of climate change impacts. Identify all VECs and their associated environment type, temporal boundary and spatial boundary. Consider if climate change can modify the VEC and document what temporal or spatial modifications should be made. The worksheet provides an example for a road construction project. As a result of climate change considerations, the VEC for water quality has been spatially scoped to reflect the predicted increase of runoff volume. If there are no anticipated modifications to VECs as a result of climate change considerations provide rationale as to why or why not.

Step 1.1 Modify VECs

Identify all VECs that may be impacted by climate change, consider modifying the scope of VEC to reflect this. This consideration will be important for determining the significance of the VEC (see Phase 3).

Step 2 Identify Additional VECs

Identify any VECs that can and should be included based on considerations of environment boundary changes as a result of climate change influences. Apply Worksheet 2 to environment boundaries. Determination and modification of VECs should be an iterative process that includes considerations of climate change throughout project life, considerations should be made to extending VEC analysis past the project lifetime. Newly identified VECs from Worksheet 2, should be examined further through use of Worksheet 1.

A full list of identified VECs should be made by combining VECs identified and modified in both Worksheets 1 and 2.

Worksheet 1. Identification of Potential Impacts from Climate Change to the VECs from Proposed Project i.e. Roadway

VEC	**Environment Type (natural, built, economic, social, or cultural)**	**Temporal Boundary**	**Spatial Boundary**	**Will Climate Change modify the temporal or spatial boundary of VEC (Y/N)**	**If Yes, how**	**Modified VEC**
Water Quality	Natural	Project Construction	10 km	Y	Climate change will increase precipitation events increasing potential runoff	Modify the spatial extent of the VEC to reflect increased runoff volume

Worksheet 2. Identification of Potential Impacts from Climate Change to the Environment Boundaries from Proposed Project

Environment Type (natural, built, economic, social, or cultural)	**Temporal Boundary**	**Spatial Boundary**	**Will Climate Change modify the temporal or spatial boundary of the environment(Y/N)**	**If Yes, how**	**If Yes, are there additional VEC not yet considered? List all that apply**

Appendix B-2: Climate Change Parameters for Scenario Analysis

This worksheet should be utilized in Phase 3 and provides an example of how proponents may examine the potential connections between climate change parameters and the components of the project. Climate change parameters may impact the project components; additionally the project components may impact the climate change parameters. Proponents should identify all project components within the pre-construction and construction, operation and decommission phases. Additional climate parameters can be examined and added if relevant to the proposed project. The potential impact should be ranked for each relationship as Not Applicable, Low, Medium or High.

Worksheet 3. Impacts of Climate Change Parameters on the Project, and Impacts of the Project on Climate Change Parameters.

Climate Parameters	Typical Project Phases/Components		
Impact of Climate Change Parameter on the Project Components / Impact of the Project Components on the Climate Parameters	Pre-Construction and Construction	Operation	Decommissioning and Abandonment
Daily Mean Temperature			
Daily Minimum Temperature			
Daily Maximum Temperature			
Frequency and/or Severity of Extreme Temperature			
Total Annual Rainfall			
Frequency and/or Severity of Precipitation Extremes (return periods)			
Relative Humidity			
Potential Evapotranspiration			
Duration of Sunlight			
Sea Level			
Lake Levels and Streamflows			
Soil Moisture and Groundwater			
Wind Velocity			
Frequency and Severity of Extreme Weather Events (other than temperature or			

precipitation)			
Arctic Sea Ice Extent			
Permafrost Extent/Levels			
Days with Ground Frost			

(Worksheet adapted from FTPCCCEA, 2003)

Appendix C Additional Resources

Appendix C-1: Considerations for Identification of Alternatives (MOECC, 2014c)

When determining the alternatives that will be considered in the environmental assessment, the proponent should, at a minimum, consider the following:

- Do they provide a viable solution to the problem or opportunity to be addressed?
- Are they proven technologies?
- Are they technically feasible?
- Are they consistent with other relevant planning objectives, policies and decisions (for example, Official Plan, Provincial Policy Statement, Growth Plans under the *Places to Grow Act, 2005*)?
- Are they consistent with provincial government priority initiatives (for example, waste diversion, energy efficiency, source water protection, reducing greenhouse gas emissions)?
- Could they affect any sensitive environmental features (for example, provincially significant wetlands, prime agricultural area, endangered species habitat, floodplains, archaeological resources, built heritage)?
- Are they practical, financially realistic and economically viable?
- Are they within the ability of the proponent to implement?
- Can they be implemented within the defined study area?
- Are they appropriate to the proponent doing the study?
- Are they able to meet the purpose of the *Environmental Assessment Act*?

Appendix C-2: Sources of Information for Practitioners

Legislative Requirements & Government Resources

- Environmental Assessment Act [EAA]. (R.S.O. 1990, c. E.18). Ontario: Ministry of the Environment and Climate Change.

- Ministry of the Environment and Climate Change [MOECC]. Environmental Approvals Access and Service Integration Branch. (2014a). *Consultation in Ontario's Environmental Assessment Process.* [Toronto]: Ministry of the Environment and Climate Change.

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Conducting Risk Assessments

- Canadian Standards Association, 1991. Risk Analysis Requirements and Guidelines CAN/CSA-Q634-91. Rexdale, ON, Canada.

- Canadian Standards Association, 1997. Risk Management: Guideline for Decision Makers CAN/CSA-Q850-97. Etobicoke, ON, Canada.

Cumulative Impact Assessment

- Hegmann, G., Cocklin, C., Creasey, R., Dupuis, S., Kennedy, A., Kingsley, L., Ross, W., Spaling, H., Stalker, D., & AXYS Environmental Consulting Ltd. (1999). Cumulative Effects Assessment Practitioners' Guide. *Canadian Environmental Assessment Agency.*

Incorporating TEK into Stakeholder Engagement Initiatives

- Crawford, S., Wehkamp, C., & Smith, N. (2009). *Translation of Indigenous/Western Science Perspectives on Adaptive Management for Environmental Assessments.* Research and Development Monograph Series. Retrieved from http://publications.gc.ca/site/eng/376548/publication.html.

Addressing Uncertainty

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Appendix D Proposed Allen Road Case Study

Purpose of the Case Study

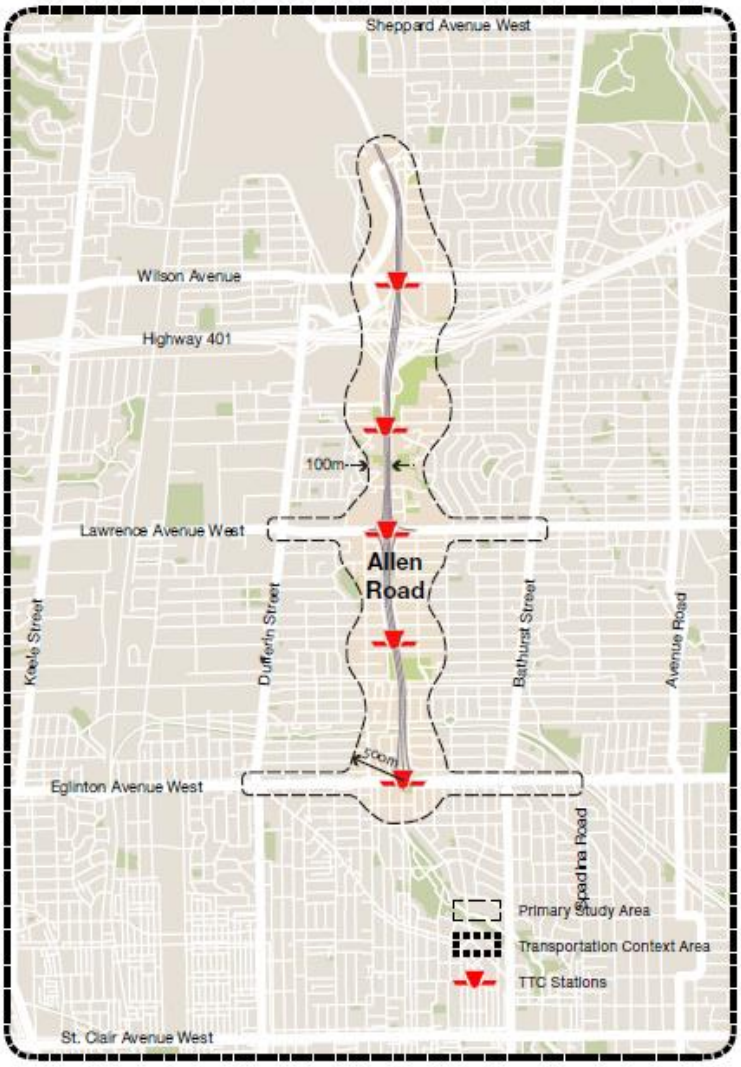
Integration of climate change adaptation and mitigation considerations into the EA process is becoming recognized in environmental management. The OCC and TRCA engaged K-NEX Consulting to produce a practitioner guideline for the integration of climate change considerations (mitigation and adaptation) into the Ontario EA process. The aim and purpose of this case study is to provide an example of how the practitioner guideline can be applied to a planning project in Ontario. The case study is an additional resource to better understand the practitioner guideline. For optimal use of the case study and enhanced understanding of the practitioner guideline, it is recommended that the Allen Road ToR (DTAH, ARUP & SWERHUN, 2014) be read prior to review of the following case study.

The Allen Road Project

The EA process for the Allen Road project commenced May 23rd, 2012. The proponent of the project is the City of Toronto. The City of Toronto will hereby be referred to as 'the proponent', and the Allen Road project will hereby be referred to as 'the project'. The project's status is ongoing; the ToR was submitted September 2014 to the MOECC (DTAH et al., 2014). The activities involved in this proposed project may not be covered within the Municipal Class EA and therefore has been proposed as an Individual EA. The expiry of the public comment period on the prepared ToR was, October 6, 2014. If the ToR is approved by the Ministry, the project will move into the EA phase, and will be subject to the requirements within the Ontario Environmental Assessment Act.

The ToR describes the City of Toronto's plan for preparing an EA to determine the future of Allen Road. The project proposal is in response to the ongoing operational issues of the existing Allen Road corridor. Issues include: the inadequate integration of the road with the growing local neighbourhood, the inability of the road to handle increasing traffic resulting in heavy congestion, long queues, and poor intersection performance. The Allen corridor is also currently not satisfying municipal and provincial policy and plan directions for sustainable transportation and neighbourhood development (DTAH et al., 2014). The proponent proposes to carry out a study to determine the future of the Allen Road corridor from Transit Road south towards Eglinton Avenue West. Figure 9 shows the project location. The ToR highlights the present challenges and future opportunities within the study area, while also defining the scope of the potential future work (DTAH et al., 2014). The ToR fulfills the initial step in the Ontario EA process, and must be consistent with the MOECC Code of Practice Guidelines for *Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario* (MOECC, 2014c). The ToR document sets out the steps that will be taken to fulfill the requirements for carrying out an Individual EA as required under the Environmental Assessment Act.

Figure 9. Study Area of the Allen Road Project (DTAH et al., 2014)



Phase 1 Statement of Purpose and Initial Considerations

Phase 1.1 Intended Purpose

The Allen Road project is a proposed upgrade of existing infrastructure to improve its original intended function as a part of a larger urban highway system. The intended purpose of the project is to examine and resolve the impacts from Allen Road on the local community, creating "an Allen that Works". While climate change is not stated as the direct rationale for the project, climate change considerations may impact the project's intended purpose (Phase 1.1, Step 2). Climate change may impact the road's function as an improved transportation corridor and as a project to reduce the road's impacts on the local community. Climate change considerations should therefore be an integral consideration throughout the EA process. Furthermore, the project objective of creating "an Allen that Works" is based upon a balance of five objectives: a State of Good Repair, Transportation Function, and Urban Design, Achieving Sustainability and Supporting Planning and Policy Context the success of all can be linked to climate change.

State of Good Repair

Objective 1 considers the importance of cost and keeping the road in a state of good repair throughout its long life-cycle. The life cycle perspective of the road lends itself to considerations of climate change on the longer time scale. This perspective should include considerations of how climate change may impact the proponent's ability to maintain this goal in the long term.

Transportation Function

Objective 2 considered the need to fully integrate Allen Road into the surrounding transportation network. The identified need for safe alternative transportation options along the project corridor including cycling and pedestrian lanes presents an opportunity for climate change mitigation through GHG reduction.

Urban Design

Objective 3 considers the need to create a sense of community along the project corridor through the development of parks and greenspaces. These are both examples of green infrastructure and are part of both climate change adaptation and mitigation.

Achieve Sustainability

Objective 4 indicates that the proponent considers sustainability to be an important aspect of the project. This provides a rationale for further climate change considerations during the EA process.

Support Planning and Policy Context

Objective 5 considers the importance of supporting provincial and city policy objectives through the development of the project, provincial and city policies and planning documents supporting climate change adaptation and mitigation strategies should be examined to meet this objective.

Phase 1.2 Identification of Alternatives

The proponent has identified six alternatives within the ToR. Currently none of the six proposed alternatives directly consider GHG emissions, or climate change adaptation and mitigation, however, components of the six alternatives have the potential to do so (refer to Phase 3 step 1 below). Any additional alternatives could consider climate change in relation to the practitioner guideline, such as considerations of additional alternatives that utilize technologies and/or measures that mitigate and/or adapt to climate change. Two existing considerations required under the Environmental Assessment Act can be integrated to address climate change when developing new alternatives and when examining the identified alternatives during the EA process.

1. Whether the alternatives are consistent with other relevant planning, objectives policies and decisions.
2. Whether the alternatives are consistent with provincial government priority initiatives (for example, waste diversion, energy efficiency, source water protection, reducing GHG emissions).

Objective 5 of the ToR requires that the project supports existing city and provincial policy objectives, there is however no specific statement regarding the need for the project to support policies or parts of policies that relate to climate change. For example, the proponent states that the project will follow the directive of the Provincial Policy Statement to, "plan for the efficient use of land, infrastructure, and public service facilities" and, "plan public streets, spaces, and facilities to meet the needs of pedestrian and cyclist movements" (DTAH et al., 2014). The 2014 Provincial Policy Statement also notes planning that considers climate change impacts, green infrastructure, and reduced GHG emissions, as a as priority in sections 1.6.1, 1.6.2 and 1.8.1. To aid in meeting Objective 5 of the ToR the proponent could incorporate the climate change criteria identified in policies such as the Provincial Policy Statement within their examination of the preferred alternatives. Furthermore, the evaluation of the six identified alternatives could follow the guidelines presented in Phases 2-5 of the practitioner guideline document to aid in integrating climate change considerations into the final determination of the best design option for the project.

The proponent has considered factors such as sustainability and life-cycle assessment within their Objective 1 and Objective 4. The inclusion of climate change is a natural extension of the existing initial considerations made by the proponent and should be continued throughout the initiation and completion of the EA.

Phase 2 Scoping

The proponent identified the spatial and temporal boundaries of the project in the ToR. The Study Area is 100 meters on either side of Allen Road with a 500 meter radius. The planning horizon identified is 25 years. It is recommended that the boundaries be modified during the EA process to reflect climate change considerations. The ToR does not indicate the identified VECs but has highlighted some preliminary areas of vulnerability and concern for the project, such as an aquifer within the project site and the potential impacts of the project on groundwater. Climate change considerations have the potential to increase or decrease the spatial and temporal boundaries of both the environment around the project and the identified VECs. Worksheets 1 and 2 of Appendix B-1 can be utilized to scope boundaries once VECs are determined.

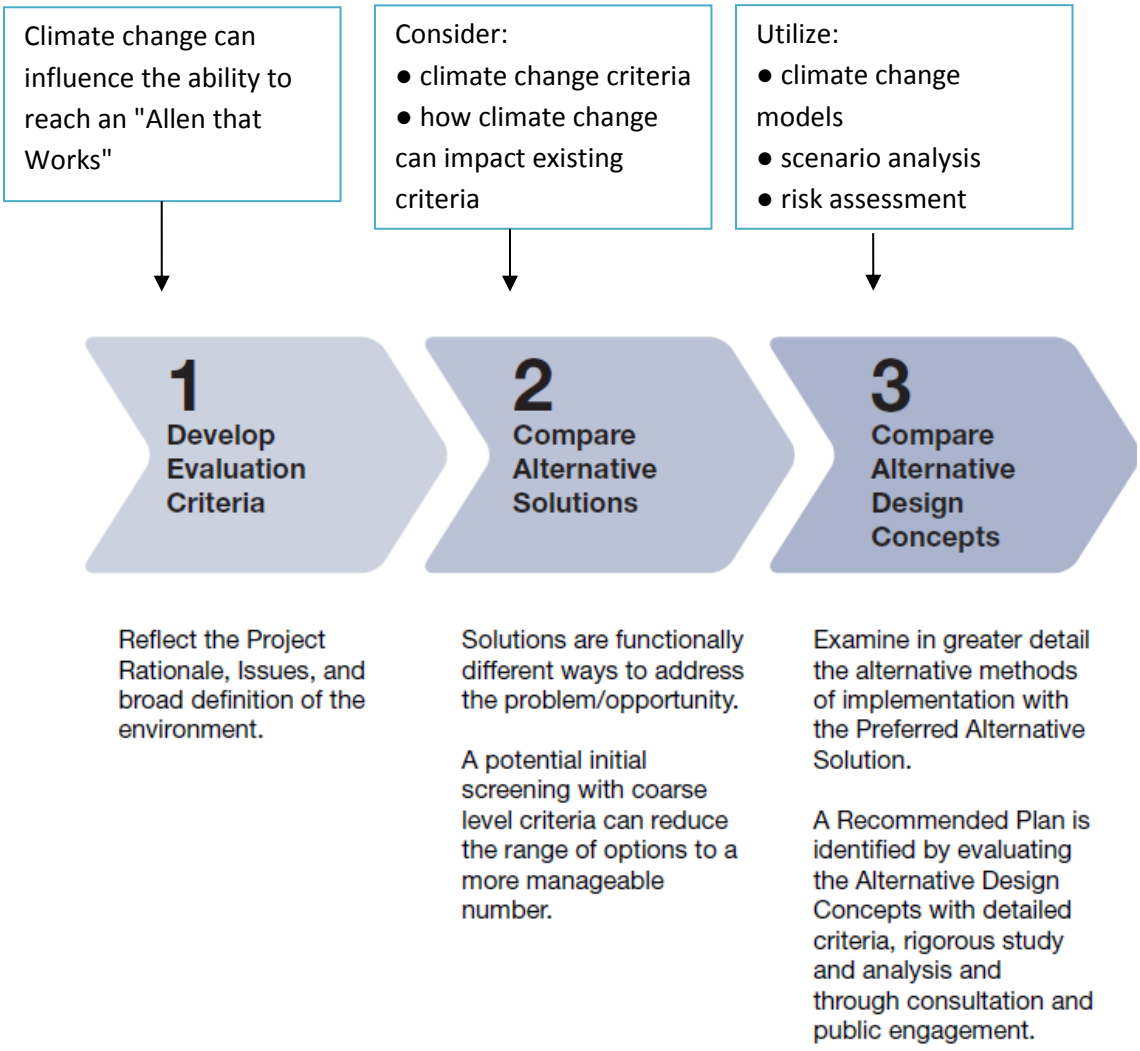
Worksheet 1 (Appendix B-1) focuses on scoping VECs. If groundwater contamination is an identified VEC, the spatial boundary of the project's impact may need to be increased past the original project boundary. This will address the increased potential for groundwater contamination due to climatic factors.

Worksheet 2 (Appendix B-1) focuses on scoping the boundaries of the environment types and identifying any additional VECs associated with the boundary changes. If built infrastructure is negatively impacted by extreme weather events, the temporal boundary of the built environment may need to be changed. If climatic conditions worsen, the road infrastructure may need reassessment prior to the 25 year lifespan based on the current climate.

Phase 3 Identifying Significant Impacts

The proponent identified an evaluation framework that will be utilized in the EA to determine the potential advantages and disadvantages of the proposed alternatives. This framework provides an opportunity to integrate climate change considerations at an evaluation level. Figure 10 displays the evaluation framework composed by the proponent. Points for climate change integration have been identified. The broad evaluation framework, with climate change consideration additions, can then be utilized by the proponent to complete the practitioner guideline's Step 1 and Step 2 of Phase 3.

Figure 10. Climate Change Integration into Proponent's Evaluation Framework



(Figure adapted from DTAH et al., 2014)

Step 1 The Potential Impact of the Project on Climate Change (GHG emissions)

The proponent has identified six potential alternatives for the project. During this step of the EA the proponent should analyze to what extent each of the alternatives will contribute to GHG emissions. A preliminary analysis of the description of alternatives, provided in the ToR, indicates that the different alternatives will have varying impacts on climate change.

Alternative 1) Do Nothing

For the purposes of comparing the levels of GHG emissions, this alternative can be utilized as a baseline. The projected levels of GHG emissions could be determine considering a business-as-usual approach. These levels can then be compared against the estimated GHG emissions of the proposed alternatives.

Solution 2) Enhance

The suggested modifications that can contribute to changes in GHG emission levels include:

- better access to public transit;
- traffic signal coordination;
- network solutions (traffic diversion);
- traffic management (such as High Occupancy Vehicle (HOV) lanes or tolls); and,
- landscape improvements increasing green space.

Solution 3) Modify

The suggested modifications that can contribute to changes in GHG emission levels include:

- dedicated travel laves for either HOV or transit;
- adding new, or widening existing bridges; and,
- introducing new cycling infrastructure.

Solution 4) Transform - Surface Road

The suggested modifications that can contribute to changes in GHG emission levels include:

- new intersections;
- new land parcels; and,
- redevelopment of available land into open space or new built form.

Solution 5) Transform - Tunnel/Deck

The suggested modifications that can contribute to changes in GHG emission levels include:

- creations of tunnel or deck; and,
- newly created lands transformed for other purposes, such as new streets, open space or new built form.

Solution 6) Transform - Remove

The suggested modifications that can contribute to changes in GHG emission levels include:

- diversion of traffic to alternative streets; and,
- redevelopment into open space or new built form.

Step 2 The Potential Impact of Climate Change on the Project

The proponent identified a preliminary list of potential changes within the study area that may directly impact the project in the future (DTAH et al., 2014 p. 34). The proponent should add climate change as a potential change that may have a direct impact on the project in the future. Additionally, the proponent can take the opportunity during the completion of this phase of the EA to analyze the identified potential changes against climate change. It could be determined if climate change can increase or decrease the magnitude of the identified potential changes within the project study area.

A number of the identified changes can be directly impacted by climate change, such as:

- transportation infrastructure;
- urban forest, landscape, streetscape, and public space blocks;
- capital and life cycle costs;
- maintenance and repair requirements;
- municipal water, stormwater and sanitary requirements; and,
- changes in air quality.

During this step, the practitioner guideline recommends the use of Worksheet 3 in Appendix B-2. The Worksheet can be used to establish climatic parameters and their impacts on project components. This worksheet has been tailored to represent the proposed project (Figure 11). It is recommended that the proponent further tailor this worksheet during this phase of the EA. Figure 11 is an example of what the proponent may consider with the first four climate parameters, the worksheet is not exhaustive. Climate change can affect the project in various ways especially regarding materials and mitigation measures.

For instance:

- freeze thaw cycle can affect the roads cracking the road surfaces and pavements;
- high precipitation can cause floods to wash away the roads and this can affect, sewer lines, hydro cables, and telephone lines;
- extreme weather conditions (winds) can destroy road fixtures; and,
- extreme summer temperature can affect the surface of the road.

Figure 11. Example Matrix for the Impacts of Climate Change Parameters on the Project, and Impacts of the Project on Climate Change Parameters (refer to Appendix B-2)

Climate Parameters	Typical Project Phases/Components						
Impact of Climate Change Parameter on the Project Components / Impact of the Project Components on the climate parameters	Construction	Operation					
	Landscape modifications	Green spaces	Bike lanes	Sidewalks	Aquifer	Storms & Sanitary Sewers	Road repairs
Wind Velocity	L	M	H	H	L	L	M
Total Annual Rainfall	L	H	M	M	H	H	M
Frequency and/or Severity of Precipitation Extremes	M	H	H	H	H	H	H
Soil Moisture and Groundwater	M	H / M	M	M	H / H	H / H	M / M
Permafrost Extent/Levels							
Days with Ground Frost							
Duration of Sunlight							

Daily Mean Temperature							
Daily Minimum Temperature							
Daily Maximum Temperature							

Phase 4 Cumulative Impacts

The proponent has identified the need to coordinate with on-going site-specific plans and projects that may influence the project impacts and function (see Table 4.3 in DTAH et al., 2014). It is recommended that the proponent review these ongoing plans for initiatives that will impact either, 1) the level of GHG emissions within the project boundary, or 2) the ability of the project to adapt to climate change impacts.

Phase 5 Impact Management

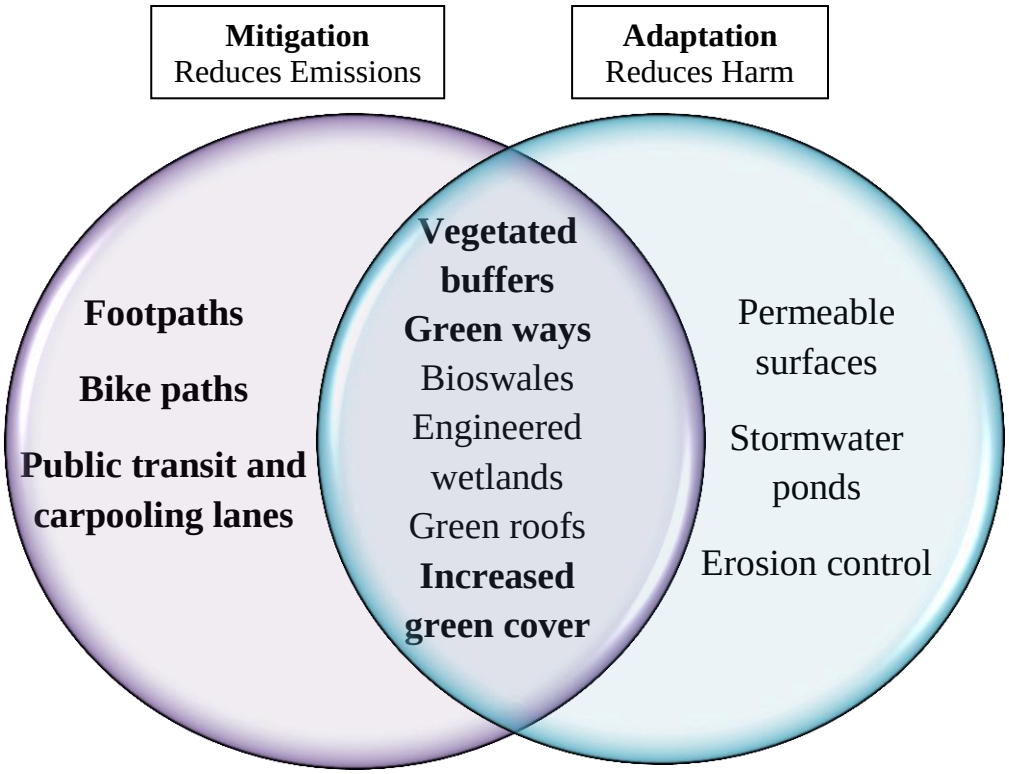
The ToR states that the alternative solutions identified will be evaluated in light of identified potential mitigation measures (DTAH et al., 2014). In addition to mitigation measures utilized specifically for the purpose of mitigating the impacts of the project, project components themselves can be adaptation or mitigation measures for climate change. The alternatives can be compared in light of these considerations as well.

The project components include:

- increased green spaces (adaptation & mitigation);
- vegetative buffers (adaptation & mitigation);
- bike lanes (mitigation);
- pedestrian walkways (mitigation); and,
- HOV lanes (mitigation).

Figure 12 adapted from Figure 7 in the guideline, illustrates the components of the project that currently follow under mitigation and adaptation measures. The project, once completed, and depending on which alternative is chosen, may have more or less of these mitigation and adaptation measures present.

Figure 12. Green Infrastructure Strategies of the Proposed Allen Road Project



Adaptation measures should be utilized when the impacts to the environment and project are unavoidable, whereas mitigation measures should be utilized to avoid the impacts to the environment and the project when, if they should occur, they are unmanageable. It is additionally a best practice to utilize measures that accomplish both mitigation and adaptation. This provides a functional redundancy and cost savings, because all levels of confidence and uncertainty can be managed under a single measure. Based on the priorities of the ToR and the proposed alternatives, adaptation measures could be further explored in the EA.

Phase 6 Monitoring and Commitments

The proponent has set a strong foundation for the completion of an adaptive management plan. In Section 10 of the ToR, "Modifications to the Approved Terms of Reference", the proponent clearly states openness to modifications as they become necessary. Additionally, the proponent has identified a commitment to the life-cycle perspective. This adaptability and a life-cycle perspective are key components of an adaptive management plan that will adjust to the changes in climate and impacts on the project in the future.

Stakeholder Engagement

The proponent has developed a public and stakeholder engagement plan in the ToR that will be further developed when executing the EA. The proponent identified opportunities for stakeholder engagement through, 1) a Technical Advisory Committee, 2) Stakeholder Meetings, 3) Government Agencies, and 4) Key Community Stakeholder Workshops. Throughout the EA, the proponent could engage stakeholders regarding climate change and the identified stakeholder engagement opportunities can be utilized to do so.

1) Technical Advisory Committee

The committee could have a climate change expert and practitioner that can aid the proponent in the creation of climate change models, scenario analysis and risk assessment.

2) Stakeholder Meetings

Stakeholder Meetings provide an opportunity for the proponent to determine how much the public supports projects that can mitigate the impacts of climate change. Additionally, this can be an opportunity to determine the degree of belief in and acceptance in the climate change projections utilized. This will ensure that all stakeholders can make informed contributions producing a strong stakeholder relationship with minimal conflict. It is recommended that the choice of methods to determine acceptable levels of climate change uncertainty reflect stakeholder attitudes towards risk and significance of impacts (i.e. if stakeholders are risk adverse), additionally understanding stakeholder attitude towards climate change risk aids in justifying decisions made, producing a strong stakeholder relationship.

3) Government Agencies

The proponent can utilize engagement with government agencies to determine if the proposed project is following policies and plans regarding climate change produced at different levels of government.

4) Key Community Stakeholder Workshops

Workshops are an opportunity to ensure that key members of the community, regardless of existing climate change knowledge, be provided with a basic understanding of climate change and be provided with knowledge regarding, 1) the technical results of climate change impact scenarios and, 2) the scientific degree of belief in and acceptance in the climate change projections utilized. This will ensure that all stakeholders can make informed contributions producing a strong stakeholder relationship with minimal conflict.

In addition to the stakeholders identified in the ToR, the proponent could consider if additional stakeholders need to be contacted that:

- have knowledge of climate change relevant to the project boundaries;
- will benefit if the project mitigates the impacts of climate change; and,
- will be impacted if the project contributes to climate change.

Identification of stakeholders with these criteria will be of importance once the proponent begins the EA process.

Uncertainty

Considerations of uncertainty within the project have not yet been mentioned. Due to the potential impacts of climate change on the Allen Road project and the potential impacts of the project on climate change in the EA, continuous re-evaluation of the nature of uncertainty could improve the proponents understanding of the existing uncertainties and the project's vulnerability to climate change.

Case Study Conclusion

The case study was utilized as an example of how the guideline can inform project planning in Ontario. As an informative demonstration the case study can be studied to improve EA practitioner understanding of the practical application of the guideline. Due to the case study being a ToR, the practitioner guideline was able to demonstrate points for integration of climate change considerations prior to the proponent's completion of the EA.